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ODONTIA SACCHARI AND O. SACCHARICOLA, NEW SPECIES ON SUGAR CANE[1]

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Among the higher fungi which have been collected by Mr. J. A. Stevenson in his pathological work at the Insular Experiment Station, Rio Piedras, Porto Rico, two species of *Odontia* on sugar cane are so well characterized as to be clearly distinct from species already known. Since Mr. Stevenson wishes to consider these fungi in a paper which will appear in the Journal of Agriculture, Porto Rico, Vol. 1, No. 4, 1917, the descriptions are now published.

Odontia Sacchari Burt, n. sp.

Type: in Burt Herb.

Fructification resupinate, effused—portions may be peeled from substratum when moistened — floccose, white, becoming ivory-yellow to pale olive-buff with age or in the herbarium, not cracked, the margin thinning out, floccose-reticulate under a lens; granules minute, sometimes so minute that they may be overlooked except in sectional preparations, crowded, about 8 to a mm.; in structure 100–300 μ thick, with the granules extending 15–45 μ more, composed of suberect, branched, loosely interwoven, hyaline hyphae $3\frac{1}{2}$–4 μ in diameter, occasionally nodose-septate, not incrusted, bearing singly along their sides in their middle region hyaline, cylindric, even

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spores 9–11×3–4 μ; basidia simple, with 2 sterigmata; basidiospores hyaline, even, subglobose, 3¾×3–3¾ μ; cystidia septate, cylindric, more or less granule-incrusted, hyaline, 6–9 μ in diameter, protruding 20–60 μ, about 1–3 to a granule at the apex.

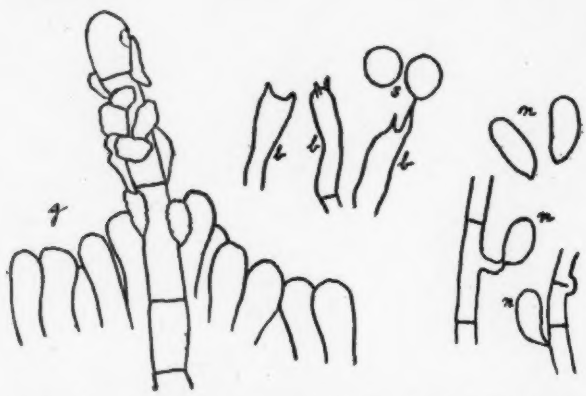

Fig. 1. O. Sacchari. Section of granule of fructification, showing young basidia and incrusted cystidium, *g*; basidia with two sterigmata, *b*; basidiospores, *s*; hyphae and lateral spores from interior of fructification, *n*. × 855.

Fructifications 3–5 cm. in diameter.

On dead sheath bases and cane trash of sugar cane. Cuba and Porto Rico. April, July, and August—the best specimen in August.

When specimens of this species were originally received from the Cuban Experiment Station in 1905, I was disposed to place the species in the genus *Peniophora,* because the hymenium was so nearly even in the dried condition. Collections recently received from Mr. Stevenson, Rio Piedras Experiment Station, show granules distinctly visible in the dry fructification. In all specimens granules show distinctly in sections prepared for microscopical examination, and each granule has one or more cystidia emerging from its apex, hence this species is a true *Odontia.* The noteworthy characters of *O. Sacchari* are its minutely granular hymenium, which is sometimes nearly even under a lens, the numerous spores

among the hyphae between the hymenium and the substratum, and the basidia with two sterigmata. The spores of the interior of the fructification are borne singly on short lateral outgrowths along the hyphae of the fructification, as shown in the accompanying figure. Only two basidiospores have been found, one of which was attached to the sterigma. Deeply staining basidia form a normal hymenium but are apparently immature, for only a very few basidia show sterigmata yet.

Specimens examined:

Cuba: Santiago de las Vegas, *W. T. Horne*, type.

Porto Rico: Rio Piedras, *J. A. Stevenson, 2908, 5628, 6382* (in Mo. Bot. Gard. Herb., 7090, 9488, and 54788 respectively, and *J. R. Johnston*, comm. by J. A. Stevenson, 4509 (in Mo. Bot. Gard. Herb., 54586).

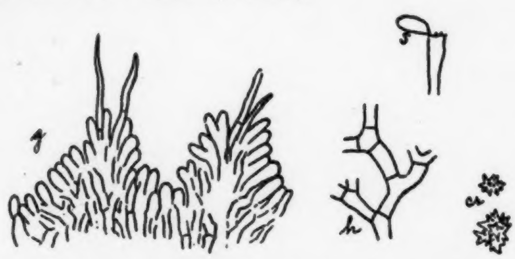

Fig. 2. O. saccharicola. Section of two granules, showing young basidia and hair-like cystidia, *g*; basidium and attached spore, *s*; hypha, *h*; stellate crystals, *cr*. × 855.

Odontia saccharicola Burt, n. sp.

Type: in Mo. Bot. Gard. Herb.

Fructification resupinate, effused, adnate, very thin, pulverulent, not cracked, whitish, drying cartridge-buff, the margin narrow and thinning out; granules minute but distinct, about 6–9 to a mm.; in structure 30–50 μ thick, with the granules extending 45–60 μ more, composed of loosely and somewhat horizontally arranged, branched, short-celled hyphae $2\frac{1}{2}$–3 μ in diameter, not nodose-septate, not incrusted but having in the spaces between hyphae numerous stellate crystals $4\frac{1}{2}$–$7\frac{1}{2}$ μ in diameter from tip of ray to tip of opposite ray; cystidia hair-like, flexuous, not incrusted, septate, weak, often

collapsed, tapering upward to a sharp point, 1½–3 μ in diameter, protruding 8–18 μ, about 1–3 to a granule at the apex; basidia simple, cylindric-clavate, with 4 sterigmata reduced to mere points; basidiospores hyaline, even, 5½ × 2½ μ, flattened on one side.

Fructifications 3–5 cm. broad, extending from the ground upward on sugar cane, in some cases 20 cm. or more and sometimes wholly surrounding the canes.

On living stalks of *Saccharum officinarum* and *Paspalum*. Porto Rico. December to February, May, June, and October—spore-bearing basidia found only in October and February collections.

This species is thinner than *O. Sacchari* and is composed of shorter-celled hyphae which are not suberect, not nodose-septate, and do not bear spores in the interior of the fructification. The stellate crystals are present abundantly in all specimens which have been received and appear to be of aid for the recognition of this species, especially so if the specimen is young.

Specimens examined:

Porto Rico: Rio Piedras, *J. A. Stevenson, 3176,* type, *564, 2657, 2657a, 3617, 6213* (in Mo. Bot. Gard. Herb., 10232, 9896, 6565, 8371, 10247, 54789 respectively); Canovanas, *J. A. Stevenson, 5502* (in Mo. Bot. Gard. Herb., 9502).

THE THELEPHORACEAE OF NORTH AMERICA. VIII[1]

CONIOPHORA

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CONIOPHORA

Coniophora De Candolle, Fl. Fr. **6**: 34. 1815; Persoon, Myc. Eur. **1**: 153. 1822; Karsten, Rev. Myc. **3**[9]: 23. 1881; Finska Vet.-Soc. Bidrag Natur och Folk **37**: 159. 1882; Sacc. Syll. Fung. **6**: 647. 1888; Massee, Linn. Soc. Bot. Jour. **25**: 128. 1889; Schroeter, Krypt.-Fl. Schlesien **3**: 430. 1888; Engl. & Prantl, Nat. Pflanzenfam. **I.1****: 120. 1898.—*Coniophora* as a subgenus of *Corticium* Fries, Hym. Eur. 657. 1874; Cooke, Grevillea **8**: 88. 1880.—*Coniophorella* Karsten, Finl. Basidsv. 438. 1889; Bresadola, Ann. Myc. **1**: 110. 1903.

Fructifications resupinate, effused, fleshy, subcoriaceous or membranaceous; hymenium somewhat undulate-tubercular, granular, or even, usually pulverulent with the spores; cystidia present in some species; basidia simple; spores even, ochraceous, sometimes nearly colorless.

Coniophora is closely connected on one side with *Corticium* and *Peniophora* by such pale-spored species as *Coniophora polyporoidea,* on another side with the colored-spored section of *Merulius,* and on still another with *Grandinia* by several species with granular or minute papillae in the hymenium, although the spores of *Coniophora* are colored, while those of *Grandinia* are white.

Fully developed, mature fructifications of *Merulius* have the hymenial surface more or less reticulate with obtuse folds, imperfectly porose, or obsoletely toothed, while the departure from the even hymenial surface in *Coniophora* is at the most only undulate-tubercular or granular. Since some species

NOTE.—Explanation in regard to the citation of specimens studied is given in Part VI, Ann. Mo. Bot. Gard. 3: 208, footnote. The technical color terms used in this work are those of Ridgway, Color Standards and Nomenclature. Washington, D. C., 1912.

[1] Issued September 20, 1917.

of *Merulius* have the hymenium even in some small, immature fructifications and with a broad, marginal, even region in larger ones, it is necessary to see fully mature and well-developed fructifications to be certain that a collection of one of these connecting species is a *Coniophora* rather than a *Merulius*. The absence of a definite statement by De Candolle on this point led Fries to question the generic position of *Coniophora membranacea* DC.

The dark color of spores in the mass in spore collections is a decisive character for distinguishing some species of *Coniophora* from *Corticium* and *Peniophora*. In working with dried herbarium specimens which lack spore collections, if the natural color pigment of sections is destroyed and bleached by KHO solution, some sections should be treated with lactic acid to determine whether the spores are hyaline or pigmented like the hyphae. In my experience lactic acid does not change a common, ochraceous, fungous pigment which is dissolved and bleached by KHO solution.

All our species of *Coniophora* are saprophytic on wood and cause dry rot of the wood. The most of these species are rare or have been collected infrequently, and record is lacking of the extent of rot which they cause. *Coniophora cerebella*, more commonly called *C. puteana*, is common and widely distributed throughout the northern United States and Canada. It is very destructive to structural timber of coniferous species if poorly seasoned or if used in moist places where there is a poor circulation of air or if used in contact with the ground without previous treatment with a wood preservative. In the United States this species seems to be as important an agent of timber decay as the *Merulius lacrymans* group of species is in Europe. While *Coniophora cerebella* attacks chiefly coniferous timber of buildings, bridges, docks, etc., in forests it is often found on logs of deciduous species. *C. arida* is another species of this genus so common as to be of economic importance. This species has been collected but rarely on other than a coniferous substratum; it ranges rather farther south than the general range of *C. cerebella* but has not been received from farther south than Louisiana.

The collections which have been available seem to indicate that *Coniophora* is more abundant in temperate than in tropical regions.

Our few species which have cystidia are not segregated as *Coniophorella,* because such segregation would place two common species, *C. suffocata* and *C. olivascens,* in the position of troublesome intermediates with some of their specimens seeming to belong in *Coniophora* in the restricted sense and others in *Coniophorella.* The per cent of connecting species is obviously too large for cleavage into natural genera.

Key to the Species

Neither incrusted nor hair-like cystidia present in the hymenium, with the exception of *C. suffocata* which sometimes has short cystidia barely distinguishable from the basidia, and of *C. olivascens,* some sections of which may lack cystidia.......... 1

Cystidia present 8

1. Fructification fleshy when growing, often 1 mm. thick, separable from substratum; hyphae densely interwoven, 4–7 μ in diameter, not incrusted .... *1. C. cerebella*

1. Fructification drying tawny olive to snuff-brown, 200–250 μ thick, not fleshy, separable from the substratum; spores fusiform, tapering at both ends, 18–21×5–6 μ.......... *2. C. fusispora*

1. Fructification not fleshy, dry; spores less than 15 μ long.......... 2

2. Spores 8×3–4 μ; fructification described originally as sulphur-cinereous and papillate.......... *7. C. sistotremoides*

2. Hymenium not papillate.......... 3

3. Fructification not stratose; spores between 10 and 13 μ long.......... 4

3. Fructification not stratose; spores less than 10 μ long.......... 6

3. Fructification stratose, snuff-brown throughout, velvety, ½–1 mm. thick .... *11. C. dryina*

4. Fructification neither stratose nor with incrusted hyphae.......... 5

4. Fructification not stratose but with incrusted hyphae, avellaneous to tawny olive and Saccardo's umber.......... *12. C. suffocata*

5. Fructification adnate, 100–500 μ thick, drying from warm buff to tawny olive or darker, with paler margin; hyphae loosely interwoven, 2–3 μ in diameter, without inflations.......... *3. C. arida*

5. Closely resembling *C. arida* but with hyphal portions occasionally swollen to 4–7 μ in diameter.......... *4. C. Kalmiae*

6. Spores ellipsoidal, 7–8×3–4 μ; hyphae with inflations 9–12 μ in diameter, and with pyriform, vesicular hyphal ends......*5. C. inflata*

6. Spores broadly ovoid.......... 7

6. Spores subglobose, 4–5×4 μ; fructification pinkish tan; hyphae not incrusted, not nodose-septate. (*C. olivascens* has nodose-septate hyphae) .... *10. C. Harperi*

7. Fructification membranaceous, separable, pinkish buff, the margin white, cottony, and usually with prominent radiating mycelial strands...... .... *6. C. polyporoidea*

7. Fructification spongy, hypochnoid, between pinkish buff and cinnamon-buff throughout and at the margin; hyphae 6–7 μ in diameter....*8. C. vaga*

7. Fructification light pinkish cinnamon, adnate; hyphae 2–2½ μ in diameter, hyaline; spores 7–8×6 μ .... *9. C. avellanea*
 8. Cystidia large, more than 5 μ in diameter 9
 8. Cystidia small, only 3–5 μ in diameter 11
9. Spores more than 7 μ long; fructification dark-colored, sepia, and buffy citrine to olive-brown 10
9. Spores 3×2 μ; fructification primuline-yellow .... *16. C. flava*
 10. Fructification very dark, drying Saccardo's umber to olive-brown throughout; hyphae rigid; cystidia protruding up to 120 μ .... *13. C. umbrina*
 10. Fructification paler, buffy citrine and Saccardo's olive to brownish olive; hyphae paler and thinner-walled, often collapsed; cystidia protruding up to 100 μ .... *14. C. olivacea*
 10. Fructification drying sepia; hyphae nearly black, rigid; cystidia protruding up to 60 μ; spores 9–10×4½–6 μ .... *15. C. atrocinerea*
11. Spores 6–7×2½–3 μ; fructification very thin, adnate, drying raw sienna, suggestive of the conidial stroma of an *Hypoxylon* .... *17. C. laeticolor*
11. Spores 4–4½×2½–3 μ, pale and concolorous with the hyphae; fructification cream-color to Naples yellow throughout; hyphae loosely interwoven, rigid, abundantly nodose-septate .... *18. C. byssoidea*
11. Spores about 5×3½ μ, dark-colored; fructification olive-lake to olive-citrine; hyphae lax, hyaline .... *19. C. olivascens*

1. **Coniophora cerebella** Pers. Myc. Eur. **1**: 155. 1822; Schroeter, Krypt.-Fl. Schlesien **3**: 430. 1888; Bresadola, Ann. Myc. **1**: 110. 1903.

Thelephora cerebella Pers. Syn. Fung. 580. 1801; Alb. & Schw. Consp. Fung. 282. 1805.—*Thelephora puteana* Schumacher, Pl. Saell. **2**: 397. 1803; Fries, Syst. Myc. **1**: 448. 1821; Elenchus Fung. **1**: 194. 1828; Pers. Myc. Eur. **1**: 144. 1822.—*Corticium* (subg. *Coniophora*) *puteanum* (Schum.) Fries, Hym. Eur. 657. 1874; Cooke, Grevillea **8**: 88. 1880.—*Coniophora puteana* (Schum.) Karsten, Finska Vet.-Soc. Bidrag Natur och Folk **37**: 159. 1882; Finl. Basidsv. 435. 1889; Patouillard, Tab. Anal. Fung. 113. *f. 253.* 1884; Sacc. Syll. Fung. **6**: 647. 1888; Massee, Linn. Soc. Bot. Jour. **25**: 129. 1889.

Illustrations: Fl. Dan. *pl. 2035;* Patouillard, Tab. Anal. Fung. *f. 253, 579;* Möller, Hausschwamm-forsch. 1: *pl. 3. f. 7; pl. 4. f. 8, 9, 11; pl. 5. f. 15;* Hennings in Engl. & Prantl, Nat. Pflanzenfam. I. 1**: *f. 67 F, G.*

Fructification broadly effused, suborbicular, fleshy, separable from the substratum, drying Isabella-color and tawny olive to Brussels brown, the margin whitish and mucedinous; hymenium even, undulate or gyrose, with low and broad,

dome-shaped tubercules; in structure 300–1000 μ thick, composed of densely interwoven, hyaline, even-walled hyphae 4–7 μ in diameter; no cystidia; basidia with 4 sterigmata; spores giving their color to the hymenium, even, 10–14×6–7 μ.

Fructifications usually about 4–6 cm. in diameter or elongated up to 15 cm. long, 5 cm. broad, sometimes larger, ⅓–1 mm. thick.

Fig. 1
C. cerebella.
Section of fructification × 45; spores × 665.

On logs and wood of both coniferous and frondose species, but more common on coniferous kinds. Quebec to District of Columbia and westward to British Columbia and California. Apparently rare in tropical America. July to February.

Well-developed specimens of *C. cerebella* are fleshy and thick and frequently have the hymenial surface protrude in broad, dome-shaped tubercules; young and thin fructifications are likely to be confused with *C. arida,* which has the same color but in section has its hyphae much less compactly interwoven and not as coarse as in *C. cerebella.*

Specimens examined:

Exsiccati: Cavara, Fungi Longobardiae, 14; Ell. & Ev., N. Am. Fungi, 1588 (in copy of Mo. Bot. Gard. Herb. but not in copies of Farlow Herb. and of U. S. Dept. Agr. Herb.); Karsten, Fungi Fenn., 135; Krieger, Fungi Sax., 1201.

Sweden: Femsjö, *E. Fries* (in Herb. Fries, determined by Fries).

Finland: *P. A. Karsten,* in Karsten, Fungi Fenn., 135.

Austria-Hungary: definite locality not given, *Strasser,* comm. by J. Bresadola.

Germany: Saxony, *W. Krieger,* in Krieger, Fungi Sax., 1201.

Italy: Pavia, *F. Cavara,* in Cavara, Fungi Longobardiae, 14.

Canada: definite locality not given, *J. Macoun, 11, 23, 44, 58, 79;* Lower St. Lawrence Valley, *J. Macoun, 13.*

Quebec: Hull, *J. Macoun, 377;* Montreal, *H. von Schrenk* (in Mo. Bot. Gard. Herb., 44053).

Ontario: Ottawa, *J. Macoun, 36, 700;* Harraby, Lake Rosseau, *E. T. & S. A. Harper, 591, 594.*

Vermont: Middlebury, *E. A. Burt,* two collections; Little Notch, *E. A. Burt.*

Massachusetts: Belmont Spring, *W. G. Farlow, 4;* Weston, *C. Bullard,* comm. by W. G. Farlow; Cambridge (in Mo. Bot. Gard. Herb., 43890).

New York: Albany, *H. D. House* (in Mo. Bot. Gard. Herb., 14831); Floodwood, *C. H. Peck;* Ithaca, *G. F. Atkinson, 2603,* and Cornell Univ. Herb., 14190, and *L. A. Zinn, 88* (the last in Mo. Bot. Gard. Herb., 9062).

New Jersey: Newfield, *J. B. Ellis,* in Ell. & Ev., N. Am. Fungi, 1588 in some copies.

Pennsylvania: Spruce Creek, *J. H. Faull, 324* (in Mo. Bot. Gard. Herb., 44928); State College, *L. O. Overholts, 2660* (in Mo. Bot. Gard. Herb., 13160).

District of Columbia: Washington, *C. L. Shear, 1268.*

Ohio: Cincinnati, *A. P. Morgan,* Lloyd Herb., 2603.

Michigan: Ann Arbor, *C. H. Kauffman, 33, 46* (the latter in Mo. Bot. Gard Herb., 6823); Escanaba, *C. J. Humphrey, 1449* (in Mo. Bot. Gard. Herb., 4825); New Richmond, *R. W. Kellet,* comm. by A. H. W. Povah, 8 (in Mo. Bot. Gard. Herb., 13263).

Illinois: River Forest, *E. T. & S. A. Harper, 829.*

Iowa: Webster Co., *O. M. Oleson, 447* (in Mo. Bot. Gard. Herb., 44054).

Missouri: St. Louis, *B. M. Duggar* (in Mo. Bot. Gard. Herb., 5687).

Montana: Missoula, *J. R. Weir, 399* (in Mo. Bot. Gard. Herb., 9535); Bonner, *J. R. Weir, 407* (in Mo. Bot. Gard. Herb., 21604).

Idaho: Priest River, *J. R. Weir, 67, 139* (the latter in Mo. Bot. Gard. Herb., 8344).

British Columbia: Sidney, *J. Macoun, 2* (in Mo. Bot. Gard. Herb., 5756); locality not given, *J. Macoun, 855,* comm. by J. Dearness (in Mo. Bot. Gard. Herb., 12410).

Washington: Bingen, *W. N. Suksdorf, 667, 880;* Olympia, *C. J. Humphrey, 6294.*

California: Berkeley, *H. A. Lee,* two collections, comm. by W. A. Setchell, 1017, 1018 (in Mo. Bot. Gard. Herb., 44243, 44244); San Francisco, *W. A. Setchell, 1034* (in Mo. Bot. Gard. Herb., 44242).

Mexico: Guernavaca, *W. A. & Edna L. Murrill, 534,* N. Y. Bot. Gard., Fungi of Mexico (in Mo. Bot. Gard. Herb., 54511).

2. **C. fusispora** (Cooke & Ell.) Cooke in Sacc. Syll. Fung. **6**: 650. 1888; Massee, Linn. Soc. Bot. Jour. **25**: 133. 1889.

Corticium fusisporum Cooke & Ell. Grevillea **8**: 11. 1879.—*Corticium fusisporum* (subg. *Coniophora*) Cooke, Grevillea **8**: 89. 1880.

Type: type and cotype in Kew Herb. and in N. Y. Bot. Gard. Herb. respectively.

Fructification effused, thin, soft, readily separable, drying from tawny olive to snuff-brown, the margin mucedinous, pallid; hymenium even, pulverulent; structure in section 200–250 μ thick with (1) a layer next to the substratum of loosely and longitudinally arranged hyphae, hyaline, thin-walled, collapsing, 4–5 μ in diameter, sometimes granule-incrusted, sometimes forming rope-like mycelial strands 20–25 μ in diameter, and with (2) a compact hymenial layer; no cystidia; spores giving the color to the fructification, fusiform, tapering at both ends, curved at the base, 18–21$\times$5–6 μ.

Fig. 2
C. fusispora.
Spores, incrusted hypha. $\times$ 665.

On pine wood in wood pile and on pine logs. Newfield, New Jersey. September.

This species is so similar to *C. cerebella* in color and probably in diameter of fructification that when Ellis collected it again, seven years after his type collection, he confused these later specimens with *C. puteana* and distributed some specimens under the latter name in some copies of his exsiccati. *C. fusispora* is distinct from *C. cerebella* by being thinner, dry rather than fleshy, having longer and more pointed spores, and by being two-layered and with the layer next to the substratum composed of very loosely arranged hyphae having

some granular incrustation rather than of a uniformly compact, fleshy, non-incrusted hyphal structure from substratum to basidia as in *C. cerebella*.

Specimens examined:

Exsiccati: Ell. & Ev., N. Am. Fungi, 1588 (in the copies of U. S. Dept. Agr. Herb. and of Farlow Herb., but not in copy of Mo. Bot. Gard. Herb.).

New Jersey: Newfield, *J. B. Ellis, 3092 to Cooke,* type (in Kew Herb.); same locality and collector, Ell. & Ev., N. Am. Fungi, 1588 (in copies of U. S. Dept. Agr. Herb. and of Farlow Herb.).

3. **C. arida** (Fr.) Karsten, Finska Vet.-Soc. Bidrag Natur och Folk **37**: 161. 1882; Sacc. Syll. Fung. **6**: 648. 1888; Massee, Linn. Soc. Bot. Jour. **25**: 132. 1889.

Thelephora arida Fries, Elenchus Fung. **1**: 197. 1828.—*Corticium aridum* (subg. *Coniophora*) Fries, Hym. Eur. 659. 1874; Cooke, Grevillea **8**: 89. 1880. — *Coniophora Cookei* Massee, Linn. Soc. Bot. Jour. **25**: 136. 1889; Sacc. Syll. Fung. **9**: 242. 1891.

Illustrations: Fries, Icones Hym. *pl. 199. f. 1.*

Type: in Herb. Fries, authentic specimen in Kew Herb.

Fructification effused, membranaceous, adnate, drying from warm buff to tawny olive or rarely darker, the margin paler and sometimes whitish; hymenium even, pulverulent; structure in section 100–500 μ thick, composed of loosely interwoven, thin-walled, often collapsing, usually hyaline hyphae 2–3 μ in diameter, not incrusted; no cystidia; basidia with 4 sterigmata, protruding; spores tawny olive in a spore collection, even, 10–12×6–7 μ.

Fig. 3
C. arida.
Section of fructification ×45; spores ×665.

Fructifications 4–20 cm. long, 1–8 cm. broad, $\frac{1}{10}$–$\frac{1}{2}$ mm. thick.

Common on prostrate limbs and logs and on under side of boards and timbers of coniferous species, rarely on frondose species. Canada to Louisiana and westward to Idaho.

Coniophora arida, although frequently confused with *C. cerebella*, is very distinct from it by brighter color and adnate habit, and dry and thin, rather than fleshy and thick, structure; in sections the hyphae of *C. arida* are only 2–4 μ in diameter, finer, thinner-walled and often collapsed, and more loosely interwoven than those of *C. cerebella*. *C. arida* and *C. cerebella* are both important timber destroyers.

Specimens examined:

Exsiccati: Cooke, Fungi Brit., ed. 2, 11, under the name *Thelephora puteana;* Ell. & Ev., Fungi Col., 1306, under the name *Coniophora Ellisii;* Romell, Fungi Exs. Scand., 37a and b.

Sweden: Femsjö, *E. Fries*, type (in Herb. Fries); *L. Romell, 207;* Stockholm, *L. Romell, 205*, and two collections in Romell, Fungi Exs. Scand., 37a and b.

England: Hampstead, in Cooke, Fungi Brit., ed. 2, 11.

Ontario: Ottawa, *J. Macoun, 19;* Port Credit, *J. H. Faull*, Univ. Toronto Herb., 308 (in Mo. Bot. Gard. Herb., 44891); Toronto, *G. H. Graham*, Univ. Toronto Herb., 683 (in Mo. Bot. Gard. Herb., 44942); Wilcox Lake, *J. H. Faull*, Univ. Toronto Herb., 647 (in Mo. Bot. Gard. Herb., 44927).

Vermont: Little Notch, near Bristol, *E. A. Burt.*

Massachusetts: Magnolia, *W. G. Farlow.*

Rhode Island: East Providence, *W. G. Farlow.*

New York: Albany, *H. D. House, 1384*, N. Y. State Mus. Herb., T2, and two unnumbered collections (in Mo. Bot. Gard. Herb., 54579, 14832, and 54383 respectively); Karner, *H. D. House*, N. Y. State Mus. Herb., 14.189, 14.203, 14.204, and an unnumbered collection (in Mo. Bot. Gard. Herb., 44723, 44724, 44726, 54381 respectively); Ithaca, *G. F. Atkinson, 29, 9238* (in Cornell Univ. Herb.).

New Jersey: Newfield, *J. B. Ellis, 3425*, cotype of *Coniophora Cookei* (in N. Y. Bot. Gard. Herb.) and the specimen in Ell. & Ev., Fungi Col., 1306.

Pennsylvania: Carbondale, *E. A. Burt.*

North Carolina: Biltmore, *E. Bartholomew, 5659* (in Mo. Bot. Gard. Herb., 44269).

Louisiana: St. Martinville, *A. B. Langlois, cz.*

Illinois: Riverside, *E. T. & S. A. Harper, 851.*

Missouri: St. Louis, *E. A. Burt* (in Mo. Bot. Gard. Herb., 54696).

Idaho: Priest River, *J. R. Weir, 83, 548* (the latter in Mo. Bot. Gard. Herb., 17806); Avery, *J. R. Weir, 393* (in Mo. Bot. Gard. Herb., 11982).

4. **C. Kalmiae** (Peck) Burt, n. comb.

Corticium Kalmiae Peck, N. Y. State Mus. Rept. **46**: 109. 1893; Sacc. Syll. Fung. **11**: 125. 1895.

Fig. 4
C. Kalmiae.
Spores; hyphae with swollen portions, p. × 665.

Type: in Coll. N. Y. State.

Fructification effused, thin, tender, adnate, drying straw-yellow to tawny olive, the subiculum and margin composed of slender, whitish filaments; hymenium glabrous, continuous; structure in section 150–300 μ thick, composed of loosely interwoven, hyaline, non-incrusted hyphae mostly 2–3 μ in diameter but with occasionally a portion of a hypha swollen and 4–7 μ in diameter; no cystidia; spores tawny olive in a spore collection, even, $9–12 \times 6–7\ \mu$.

Fructification 3–4 cm. long, 2–3 cm. broad.

On prostrate limbs and logs of frondose species, a single collection on hemlock spruce. Vermont and New York. September and October. Rare.

The type of this species is bright straw-yellow; the other collections which I have referred here have similar structure but are rather darker, approaching *C. arida,* from which, perhaps, *C. Kalmiae* is not specifically distinct. The occasional swollen portions of hyphae afford the best character for separation from *C. arida.*

Specimens examined:

Vermont: Little Notch, near Bristol, *E. A. Burt.*

New York: Shokan, *C. H. Peck,* type (in Coll. N. Y. State); Ithaca, *C. H. Kauffman,* Cornell Univ. Herb., 14191; *C. Thom,* Cornell Univ. Herb., 14192—both of the Ithaca specimens comm. by G. F. Atkinson.

5. **C. inflata** Burt, n. sp.

Type: in Mo. Bot. Gard. Herb.

Fructification effused, dry, membranaceous, separable, drying avellaneous, the margin mucedinous, concolorous in some places, deep olive-buff in others; hymenium even, pulverulent; in structure 300 μ thick, with hyphae next to the substratum very loosely arranged, colored, forming some rope-like strands up to 15 μ in diameter; hyphae 3–6 μ in diameter, here and there globosely inflated up to 9–12 μ in diameter, and sometimes with pyriform or subglobose, vesicular branches or hyphal ends up to 12×9 μ; no cystidia; spores colored, even, 7–8× 3–4 μ.

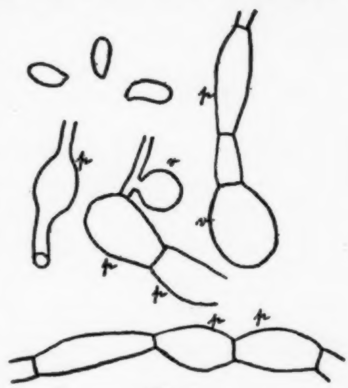

Fig. 5
C. inflata.
Spores; hyphae with inflated portions, *p*, and vesicular ends, *v*. × 665.

Fructifications 5–10 cm. long, 3–5 cm. broad.

On a pine box in contact with the soil in a garden. Parral, Mexico. August.

This species is characterized by fructification becoming separable from substratum, by dry and loosely interwoven structure, by inflated or vesicular hyphal organs, and by smaller spores than any of the preceding species. The dry rot caused in the pine wood is of the brown, brittle type. The vesicular organs do not appear to be chlamydospores.

Specimens examined:

Mexico: Parral, Chihuahua, *E. O. Matthews, 22,* type (in Mo. Bot. Gard. Herb., 4511).

6. **C. polyporoidea** (Berk. & Curtis) Burt, n. comb.

Corticium polyporoideum Berk. & Curtis, Grevillea **1**: 177. 1873; Sacc. Syll. Fung. **6**: 618. 1888; Massee, Linn. Soc. Bot. Jour. **27**: 130. 1890. — *Corticium alboflavescens* Ell. & Ev. Acad. Nat. Sci. Phila. Proc. **1894**: 324. 1894; Sacc. Syll. Fung.

11 : 124. 1895. — *Coniophora alboflavescens* (Ell. & Ev.) v. Höhn. & Litsch. K. Akad. Wiss. Wien Sitzungsber. **116** : 791. 1907.—*Coniophora Petersii* v. Höhn. & Litsch. K. Akad. Wiss. Wien Sitzungsber. **117** : 1086. 1908, but not *Corticium Petersii* Berk. & Curtis.

Type: type and cotype in Kew Herb. and Curtis Herb.

Fig. 6
C. polyporoidea.
Spores, hyphae. × 665.

Fructification effused, membranaceous, separable, drying pinkish buff, the margin white, cottony, often with radiating mycelial strands; hymenium even, pulverulent; in structure 400–1000 μ thick, composed (1) of a supporting layer of very loosely interwoven, hyaline hyphae $2\frac{1}{2}$–3 μ in diameter, incrusted with scattered granules, and (2) of a compact hymenium; no cystidia; spores slightly colored under the microscope, even or slightly rough, $6–8 \times 4\frac{1}{2}–6$ μ.

Fructifications 1–15 cm. long, 1–5 cm. broad.

On prostrate fallen limbs and wood of various frondose and, more rarely, coniferous species, and on bark at bases of trees. New Hampshire to Florida and westward to Michigan and Arkansas. June to March.

This fine species has the color and surface texture of buckskin leather and a distinctly white margin. The spores differ from those of other species of the genus in having so little color and in absorbing eosin stain so intensely that their original color is masked by the dye and the species likely to be mistaken for a *Corticium*. The roughish spores show relationship to *Hypochnus*.

Specimens examined:

Exsiccati: Ell. & Ev., N. Am. Fungi, 1716, under the name *Corticium Petersii,* and 3005, under the name *Corticium alboflavescens;* Ell. & Ev., Fungi Col., 608, under the name *Corticium Petersii,* and 403, under the name *Corticium alboflavescens;* Ravenel, Fungi Am., 125, under the name *Cor-*

ticium ochroleucum, and 723, under the name *Corticium Petersii.*

New Hampshire: Chocorua, *W. G. Farlow, 19.*

Vermont: Middlebury, *E. A. Burt.*

New York: Alcove, *C. L. Shear, 1213;* Copake, *C. H. Peck*, N. Y. State Mus. Herb., T8 (in Mo. Bot. Gard. Herb., 54580); East Galway, *E. A. Burt*, two collections; Fort Ann, *S. H. Burnham, 46* (in Mo. Bot. Gard. Herb., 54424); Gansevoort, *C. H. Peck*, N. Y. State Mus. Herb., T29 (in Mo. Bot. Gard. Herb., 54786); Karner, *H. D. House* (in Mo. Bot. Gard. Herb., 54382).

North Carolina: Asheville, *H. C. Beardslee, 02125;* Blowing Rock, *G. F. Atkinson, 4196, 4319, 4329* (the last in Cornell Univ. Herb.).

South Carolina: Seaboard, in Ravenel, Fungi Am., 723.

Georgia: Tallulah Falls, *A. B. Seymour*, comm. by W. G. Farlow, FF.

Florida: *W. W. Calkins* (in U. S. Dept. Agr. Herb.), and in Ell. & Ev., N. Am. Fungi, 1716; Gainesville, *Ravenel*, in Ravenel, Fungi Am., 125.

Alabama: *Peters*, type and cotype (in Kew Herb. and in Curtis Herb., 4559).

West Virginia: Nuttallburg, *L. W. Nuttall*, type distributions of *Corticium alboflavescens*, in Ell. & Ev., N. Am. Fungi, 3005, and Fungi Col., 403.

Michigan: Ann Arbor, *C. H. Kauffman, 35.*

Ohio: Cincinnati, *C. G. Lloyd, 4525.*

Kentucky: Harlan, *C. H. Kauffman, 67* (in Mo. Bot. Gard. Herb., 16419); Mammoth Cave, *C. G. Lloyd, 2561.*

Arkansas: Fordyce, *C. J. Humphrey, 5828*; Arkansas National Forest, *W. H. Long, 19861* (in Mo. Bot. Gard. Herb., 8959); Womble, *W. H. Long, 19791* (in Mo. Bot. Gard. Herb., 6388).

7. **C. sistotremoides** (Schw.) Massee, Linn. Soc. Bot. Jour. **25**: 133. 1889; Sacc. Syll. Fung. **9**: 241. 1891.

Thelephora sistotremoides Schweinitz, Naturforsch. Ges. Leipzig Schrift. **1**: 109. 1822; Am. Phil. Soc. Trans. N. S.

4 : 168. 1832; Fries, Elenchus Fung. 1 : 198. 1828. — *Odontia sistotremoides* (Schw.) Fries, Epicr. 529. 1838.

Type: a fragment in Herb. Schweinitz and portions in Herb. Fries and in Kew Herb. probably.

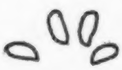

Fig. 7
C. sistotremoides.
Spores × 665.

Effused, papery, papillate, sulphur-cinereous, the margin byssoid and white; papillae minute, pilose.

Broadly effused here and there on wood. Papillae abnormal, minute, occurring in the hymenium in scattered distant clusters, with the form in all respects of the teeth of *Sistotrema* and clothed with hairs as in *T. botryoides*.

—Translation of original description.

The portion of the type in Herb. Schweinitz is very small and not well preserved. I found its spores Saccardo's melleus, even, 8 × 3–4 μ, and hyphae of the same color, but did not detect scattered, clustered granules in the hymenial surface. The portion preserved may, however, have been from the even region between the clustered granules. Fries received a specimen of *C. sistotremoides* from Schweinitz and in 'Epicrisis' transferred this species to *Odontia,* placing it next to *Odontia fimbriata* and describing the granules as wart-like, minute, dentiform, with apex concolorous and fimbriate.

I have been on the lookout for a *Coniophora* which combines in one specimen both the granular surface described by Schweinitz and Fries and the spore characters of the authentic specimen but have not yet found it. *Coniophora olivascens* has a granular surface to its fructification, but its spores are smaller than those of *C. sistotremoides,* more subglobose in form, and its hyphae are hyaline. Schweinitz's statement that the papillae are clothed with hairs as in his *Hypochnus botryoides* is important in showing that he refers to a surface composed of matted hyphae as seen with a lens in the case of *Hypochnus botryoides* and not necessarily to the presence of hair-like cystidia protruding from the granules in sections, although Fries must have had the latter type of structure in mind to lead him to place this species in *Odontia* between *O. Barba Jovis* and *O. fimbriata.*

The northern specimens cited below have the approximate spore characters of *C. sistotremoides* but an even hymenium, hence they are all referred with doubt to this species for the present. Possibly the granular condition of this species may be confined to the vicinity of North Carolina.

Specimens examined:

Vermont: Grand View Mt., *E. A. Burt.*

Massachusetts: Magnolia, *W. G. Farlow;* Manchester, *W. G. Farlow, 3.*

New York: Alcove, *C. L. Shear, 1130.*

North Carolina: *Schweinitz,* type (in Herb. Schweinitz).

8. **C. vaga** Burt, n. sp.

Type: in Mo. Bot. Gard. Herb.

Fig. 8
C. vaga.
Basidium with sterigmata, spores, hypha. × 665.

Fructification effused, spongy, hypochnoid, tomentose, drying between pinkish buff and cinnamon-buff, the margin thinning out and concolorous; in structure 300 μ thick, composed of loosely interwoven, short-celled, suberect hyphae 6–7 μ in diameter, not incrusted, not nodose-septate, slightly colored and giving their color to the fructification; no cystidia; spores slightly colored, concolorous with the hyphae, even, apiculate, $7\frac{1}{2}$–$9 \times 4\frac{1}{2}$–$6\ \mu$.

Fructifications 8 cm. or more long, 3 cm. broad.

On bark of old log of *Ulmus americana.* Hudson Falls, New York. September.

In its general appearance *C. vaga* somewhat resembles *Corticium vagum* but the former is more compact and darker colored, and its spores are colored, shorter, broader, and almost mucronate-pointed.

Specimens examined:

New York: Hudson Falls, *S. H. Burnham, 20,* type (in Mo. Bot. Gard. Herb., 54498).

9. **C. avellanea** Burt, n. sp.

Type: in Burt Herb.

Fructification effused, dry, adnate, drying light pinkish cinnamon (exactly avellaneous of Saccardo's 'Chromotaxia'), the margin concolorous, determinate; hymenium even, pulverulent; in structure 120–200 μ thick, with the hyphae 2–2½ μ in diameter, hyaline, not incrusted, not nodose-septate, running longitudinally and crowded together along the substratum, densely interwoven in the subhymenium; no cystidia; spores olive-buff in spore collection, only slightly colored under the microscope, even, 7–8×6 μ.


Fig. 9
C. avellanea.
Spores × 665.

Fructification 3–5 cm. long, 1–3 cm. broad.

On decorticated coniferous wood. New York and Ohio. April and August.

C. avellanea differs from all the preceding species by its avellaneous color, closely adnate habit, thin and dense structure, fine hyphae, and nearly subglobose, slightly colored spores. *C. Harperi* is of nearly the same color, but has a loosely interwoven subiculum next to the substratum, coarser hyphae, and smaller spores.

Specimens examined:

New York: Altamont, *E. A. Burt;* East Galway, *E. A. Burt,* type.

Ohio: Madisonville, *C. G. Lloyd, 0191.*

10. **C. Harperi** Burt, n. sp.

Type: in Burt Herb.

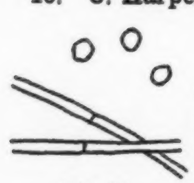
Fig. 10
C. Harperi.
Spores, hyphae.
× 665.

Fructification effused, dry, membranaceous, drying pinkish tan, brittle, not strongly attached to the substratum, the subiculum and margin whitish, floccose; hymenium even, pulverulent; in structure 150–200 μ thick, composed of loosely interwoven, suberect, hyaline hyphae not incrusted, not nodose-septate, 3½–5 μ in diameter; no cystidia; spores slightly colored, even, sometimes slightly subangular, subglobose, 4–5×4 μ.

Fructification 3–7 cm. long, 2–3 cm. broad.

On white oak bark. Lake Geneva, Wisconsin. July.

This collection was at first referred to *C. olivascens,* but it differs from it in having no olivaceous component in its color, and its spores are subglobose and slightly subangular and its hyphae not nodose-septate. The fructifications are suggestive of *Corticium arachnoideum* in forming a delicate hymenial pellicle which is supported on a very thin and loose subiculum, but the hymenium and the spores are colored.

Specimens examined:

Wisconsin: Lake Geneva, *E. T. & S. A. Harper, 958,* type.

11. **C. dryina** (Berk. & Curtis) Massee, Linn. Soc. Bot. Jour. **25** : 135. 1889.

Corticium dryinum Berk. & Curtis, Grevillea **1** : 179. 1873; Sacc. Syll. Fung. **6** : 634. 1888.

Type: type and cotype in Kew Herb. and Curtis Herb. respectively.

Fig. 11
C. dryina.
Section of fructification showing stratose structure × 45; spores × 665.

Fructification effused, thick, dry, adnate, velvety, drying snuff-brown both externally and within; hymenium even, velvety; in structure 500–1000 μ thick with (1) next to the substratum a thin layer composed of closely interwoven, thick-walled, rigid hyphae 4–4½ μ in diameter, nodose-septate, not incrusted, concolorous with the fructification, and with (2) a broad stratose hymenial layer made up of about 4 or 5 sets of hymenia and supporting subhymenial layers whose hyphae are erect, branching, concolorous, 4–4½ μ in diameter; no cystidia; basidia colored like the fructification, with 4 sterigmata; spores concolorous with the fructification, even, curved, pointed at the place of attachment, 8–9×3½–4 μ.

Fructification probably large, in the specimens known being about 4 cm. long, 3 cm. broad, and not having the original margin.

On rough surface of decaying oak wood. Alabama. November.

It is surprising that only the original collection of *C. dryina* has been made, for the two portions which are the type and cotype were apparently from a large conspicuous fructification. *C. dryina* has as distinguishing characters its thickness, snuff-brown color throughout, velvety surface, absence of cystidia, and stratose structure.

Specimens examined:

Alabama: *Peters, 709,* type and cotype (in Kew Herb. and Curtis Herb., 5204, respectively).

12. **C. suffocata** (Peck) Massee, Linn. Soc. Bot. Jour. **25**: 138. 1889.

Corticium suffocatum Peck, N. Y. State Mus. Rept. **30**: 48. 1879; Sacc. Syll. Fung. **6**: 621. 1888.

Type: in Coll. N. Y. State.

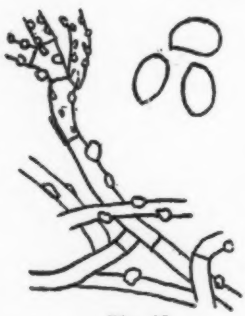

Fig. 12
C. suffocata.
Incrusted hyphae, spores. × 665.

Fructification effused, indeterminate, membranaceous, not fleshy, somewhat separable when thick, drying from avellaneous to tawny olive and Saccardo's umber, the under side and margin usually whitish and mucedinous; hymenium even; in structure 60–500 μ thick, composed of loosely interwoven, usually hyaline, sometimes brownish, more or less incrusted hyphae $3\frac{1}{2}$–6 μ in diameter under the incrustation, not nodose-septate; no cystidia or with cystidia barely distinguishable from immature basidia; spores snuff-brown in a spore collection, even, 10–12×6–7 μ.

Fructification 2–9 cm. long, 1–5 cm. broad.

Common on under side of coniferous boards and limbs lying on the ground, rare on frondose species. Canada to Louisiana and westward to Vancouver Island and Washington. May to January.

This species bears some resemblance to *C. cerebella* and *C. arida,* approaching the former in its separable tendency when thick and the latter in general habit, coloration, dry structure, and loose arrangement of its hyphae. It is distin-

guished from both species by having incrusted hyphae which are coarser than those of *C. arida.* The European *C. Betulae* Karst., of which I have an authentic specimen, does not form a compact hymenial membrane, is very thin, not at all separable from substratum, has the margin similar to the central portion of the fructification, hyphae frequently nodose-septate, and cystidia always present, 6 μ in diameter, emerging 20–30 μ above the basidia—differing in all the above respects from our *C. suffocata.* *C. subcinnamomea* Karst. differs by having in its hymenium noteworthy branching paraphyses and small, flexuous cystidia. *C. suffocata* is probably very destructive as a timber rot. The cystidia when occasionally distinguishable are about 6 μ in diameter and emerge up to 20 or even 40 μ above the basidia.

Specimens examined:

Exsiccati: Ellis, N. Am. Fungi, 328, under the name *Hymenochaete Ellisii;* Ell. & Ev., Fungi Col., 219, under the name *Coniophora puteana.*

Canada: Lower St. Lawrence Valley, *J. Macoun, 7, 48, 55.*

Ontario: Ottawa, *J. Macoun, 416;* Toronto, *G. H. Graham,* Univ. Toronto Herb., 681 (in Mo. Bot. Gard. Herb., 44939).

Vermont: Middlebury, *E. A. Burt.*

Massachusetts: Belmont Spring, *C. Bullard,* comm. by W. G. Farlow, 3, and an unnumbered specimen; Hammond's Pond, Brookline, *G. R. Lyman, 176.*

New York: Alcove, *C. L. Shear, 1303;* East Galway, *E. A. Burt;* Ithaca, *G. F. Atkinson, 997;* Karner, *H. D. House,* N. Y. State Mus. Herb., 14.165 (in Mo. Bot. Gard. Herb., 44714); Sandlake, *C. H. Peck,* type (in Coll. N. Y. State).

New Jersey: Newfield, *J. B. Ellis,* in Ellis, N. Am. Fungi, 328, and in Ell. & Ev., Fungi Col., 219, and on white oak, Feb. 3, 1877 (in Farlow Herb.).

Pennsylvania: State College, *C. R. Orton,* comm. by L. O. Overholts, 2897 (in Mo. Bot. Gard. Herb., 5719).

District of Columbia: Rock Creek, *C. L. Shear, 1350.*

Florida: *W. W. Calkins* (in U. S. Dept. Agr. Herb., under the name *Corticium epichlorum*).

Louisiana: St. Martinville, *A. B. Langlois, cg.*

Indiana: Millers, *E. T. & S. A. Harper, 648.*
Illinois: Glenellyn, *E. T. & S. A. Harper, 956.*
Missouri: Creve Coeur, *E. A. Burt* (in Mo. Bot. Gard. Herb., 54782).
Montana: Evaro, *J. R. Weir, 432* (in Mo. Bot. Gard. Herb., 1807).
Idaho: Priest River, *J. R. Weir, 8.*
British Columbia: Vancouver Island, *J. Macoun,* comm. by J. Dearness, V 134 (in Mo. Bot. Gard. Herb., 23093).
Washington: Bingen, *W. N. Suksdorf, 868, 895, 956;* Kalama, *C. J. Humphrey, 6226;* Olympia, *C. J. Humphrey, 6335.*

13. **C. umbrina** Alb. & Schw. ex Fries in Sacc. Syll. Fung. **6**: 652. 1888; Massee, Linn. Soc. Bot. Jour. **25**: 131. 1889.

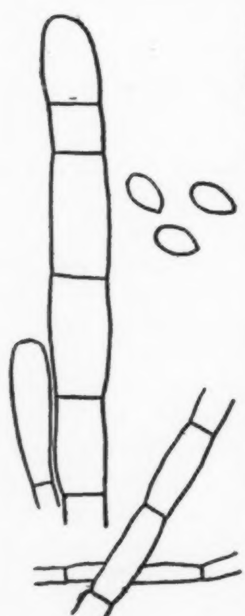

Fig. 13
C. umbrina.
Young basidium, upper portion of cystidium, spores, hyphae. × 665.

Thelephora umbrina var. β. Alb. & Schw. Consp. Fung. 281. 1805.—*Thelephora umbrina* (Alb. & Schw.) Fries, Elenchus Fung. **1**: 199. 1828; Epicr. 543. 1838. — *Corticium* (subg. *Coniophora*) *umbrinum* (Alb. & Schw.) Fries, Hym. Eur. 658. 1874.—*Coniophorella umbrina* (Alb. & Schw.) Bresadola, Ann. Myc. **1**: 111. 1903.

Type: location of type unknown to me.

Fructification effused, soft, not readily separable, villose beneath, drying Saccardo's umber to olive-brown, the margin usually of the same color, narrow, radiating; hymenium even, sometimes granular, tomentose, setulose; in structure 180–400 μ thick, with the hyphae colored, 3–6 μ or rarely more in diameter, rather rigid, not nodose-septate, loosely interwoven; cystidia concolorous, septate, obtuse, 100–200×9–12 μ, emerging up to 120 μ, even or granule-incrusted; spores concolorous under the microscope, even, 9–12×5–6 μ, flattened on one side.

Fructifications up to 3–8 cm. long, 2–4 cm. broad.

Under rotting pine boards and limbs on the ground. New York, Maryland, and Washington. October to December. Probably rare.

This species is characterized by its dark color—usually olive-brown—dark-colored hyphae, and very large, septate, colored, incrusted cystidia. Our American specimens agree well with that from Europe received from Bresadola, whose view of this species I follow.

Specimens examined:

Russian Poland: *Eichler*, comm. by G. Bresadola.
New York: Alcove, *C. L. Shear, 1326.*
Maryland: Takoma Park, *C. L. Shear, 997.*
Washington: Bingen, *W. N. Suksdorf, 869, 870.*

14. **C. olivacea** (Fr.) Karsten, Finska Vet.-Soc. Bidrag Natur och Folk **37** : 162. 1882; Sacc. Syll. Fung. **6** : 649. 1888; Massee, Linn. Soc. Bot. Jour. **25** : 129. 1889; Bresadola, I. R. Accad. Agiati Atti III. **3** : 116. 1897.

Hypochnus olivaceus Fries, Obs. Myc. **2** : 282. 1818 (in part).—*Thelephora olivacea* Fries, Elenchus Fung. **1**:197. 1828 (in part).—*Corticium* (subg. *Hypochnus*) *olivaceum* Fries, Hym. Eur. 660. 1874 (in part).—*Corticium* (subg. *Coniophora*) *olivaceum* (Fr.) Cooke, Grevillea **8** : 89. 1880.—*Coniophorella olivacea* (Fr.) Karsten, Finl. Basidsv. 438. 1889; Bresadola, Ann. Myc. **1** : 110. 1903.—*Corticium leucothrix* Berk. & Curtis, Grevillea **2** : 4. 1873.—*Corticium* (subg. *Coniophora*) *leucothrix* (Berk. & Curtis) Cooke, Grevillea **8** : 89. 1880.—*Coniophora leucothrix* (Berk. & Curtis) Cooke in Sacc. Syll. Fung. **6** : 648. 1888; Massee, Linn. Soc. Bot. Jour. **25** : 133. 1889.—*Corticium brunneolum* Berk. & Curtis, Grevillea **2** : 4. 1873. —*Corticium* (subg. *Coniophora*) *brunneolum* (Berk. & Curtis) Cooke, Grevillea **8** : 88. 1880. — *Coniophora brunneola* (Berk. & Curtis) Cooke in Sacc. Syll. Fung. **6** : 648. 1888; Massee, Linn. Soc. Bot. Jour. **25** : 134. 1889.—*Hymenochaete Ellisii* Berk. & Cooke, Grevillea **4** : 162. 1876. — *Corticium* (subg. *Coniophora*) *Ellisii* (Berk. & Cooke) Cooke, Grevillea **8** : 89. 1880.—*Coniophora Ellisii* (Berk. & Cooke) Cooke in

Sacc. Syll. Fung. **6** : 648. 1888; Massee, Linn. Soc. Bot. Jour. **25** : 129. 1889.—*Coniophora fulvo-olivacea* Massee, Linn. Soc. Bot. Jour. **25** : 134. 1889; Sacc. Syll. Fung. **9** : 241. 1891.

Type: in Herb. Fries; the specimen in Kew Herb. from Fries and named by him *Thelephora olivacea* is *Coniophora Betulae.*

Fructification effused, adnate, somewhat felt-like, and separable from the substratum with a scalpel, drying buffy citrine and Saccardo's olive to brownish olive, the margin thinning out and sometimes whitish; hymenium even, tomentose, setulose; in structure 200–700 μ thick, composed of more or less colored hyphae 3–6 μ in diameter, not nodose-septate, not usually incrusted, which are loosely interwoven next to the substratum and form a very dense hymenial layer; cystidia septate, granule-incrusted, tapering upward, concolorous with the hyphae at the base, paler above, 8–12 μ in diameter, protruding 50–100 μ; spores colored, even, 7–12×4½–5½ μ, often flattened on one side.

Fig. 14
C. olivacea.
Spores, protruded portion of cystidium, hyphae. × 665.

Fructification 4–10 cm. long, 2–5 cm. broad.

On coniferous wood and bark, rarely on frondose species. Canada to Louisiana and westward to Idaho.

C. olivacea is paler externally and internally than *C. umbrina,* has fewer cystidia, and hyphae with usually thinner walls and often collapsed. I have been able to detect no morphological characters which sharply separate these species. I was not able to study in Herb. Fries the original collection from Femsjö of *Coniophora olivacea,* for the specimen was loaned to Bresadola when I was at Upsala. I have presented *C. olivacea* as understood by Bresadola in the specimen communicated to me by him and cited below. The specimen of

Thelephora olivacea from Fries in Kew Herb., determined by Fries, has small, non-septate cystidia and incrusted hyphae, and is quite different from *C. olivacea* as understood by Bresadola. The specimen in Kew Herb. is not distinct from *Coniophora Betulae* Karst.

Specimens examined:

Exsiccati: Ell. & Ev., N. Am. Fungi, 3211; Krieger, Fungi Sax., 2011; Rabenhorst-Winter, Fungi Eur., 2721.

Finland: *Karsten,* in Rabenhorst-Winter, Fungi Eur., 2721 (in Kew Herb., the type of *Coniophora fulvo-olivacea*).

Sweden: *L. Romell, 209;* Stockholm, *L. Romell, 208.*

Germany: Schandau, *W. Krieger,* in Krieger, Fungi Sax., 2011.

Austria-Hungary: *G. Bresadola.*

Canada: *J. Macoun, 252;* St. Lawrence Valley, *J. Macoun, 67.*

Ontario: Ottawa, *J. Macoun, 382.*

New Hampshire: Chocorua, *W. G. Farlow.*

Vermont: Middlebury, *E. A. Burt.*

New York: Floodwood, *C. H. Peck;* Ithaca, *G. F. Atkinson, 2516; A. J. Pieters,* Cornell Univ. Herb., 5261; *G. F. Atkinson,* Cornell Univ. Herb., 14352; Karner, *H. D. House* (in Mo. Bot. Gard. Herb., 54395).

New Jersey: Newfield, *J. B. Ellis,* in Ell. & Ev., N. Am. Fungi, 3211.

Pennsylvania: Trexlertown, *W. Herbst.*

Maryland: Takoma Park, *C. L. Shear, 969.*

South Carolina: Society Hill, *M. A. Curtis, 4775,* the cotype of *Corticium leucothrix* (in Curtis Herb.).

Georgia: Tallulah Falls, *A. B. Seymour & W. L. Moss,* comm. by W. G. Farlow, a (in Mo. Bot. Gard. Herb., 44596).

Alabama: Bessie Junction, *C. J. Humphrey, 5355.*

Louisiana: *Dr. Hale,* the cotype of *Corticium brunneolum* (in Curtis Herb., 3664); Abita Springs, *A. B. Langlois, 2695, 2696.*

Ohio: Linwood, *C. G. Lloyd, 02834.*

Missouri: Creve Coeur, *E. A. Burt* (in Mo. Bot. Gard. Herb., 54770); St. Louis, *E. A. Burt* (in Mo. Bot. Gard. Herb., 54781).

Montana: Banner, *J. R. Weir, 405* (in Mo. Bot. Gard. Herb., 10582).

Idaho: Kaniksu National Forest, Priest River, *J. R. Weir, 68.*

15. **C. atrocinerea** Karsten in de Thümen, Myc. Univ. 1806. 1881; Soc. pro Fauna et Flora Fennica Meddel. **6** : 12. 1881; Finska Vet.-Soc. Bidrag Natur och Folk **37** : 162. 1882; Sacc. Syll. Fung. **6** : 650. 1888; Massee, Linn. Soc. Bot. Jour. **25** : 132. 1889.

Coniophorella atrocinerea Karsten, Finl. Basidsv. 438. 1889.

Type: type distribution in de Thümen, Myc. Univ., 1806.

Fig. 15
C. atrocinerea.
Protruded part of cystidium, spores, hypha. × 665.

Fructification effused, byssoid-membranaceous, adnate, drying sepia, the margin somewhat mucedinous and paler, sometimes whitish; hymenium even; in structure 250–500 μ thick, composed of loosely interwoven, nearly black, rigid, even hyphae 3½–5 μ in diameter, not nodose-septate, not incrusted; cystidia incrusted, septate, 9–15 μ in diameter, emerging up to 60 μ; spores colored, even, 9–10×4½–6 μ.

Fructifications 1–2 cm. long, 1 cm. broad, becoming confluent in crevices of the bark so as to form patches up to 8 cm. long.

In crevices of bark of pine logs. Louisiana. January.

The Louisiana collection agrees closely with the type distribution from Finland in all respects except in having slightly broader spores, which are 6 μ in diameter in the American specimen and usually about 4½ μ in the type, although published by Karsten as 5–6 μ. This species is very distinct by its firm, rigid, and nearly black hyphae. It is strange that two specimens of so similar and marked structure occur at such widely distant localities without intermediate stations.

Specimens examined:

Exsiccati: de Thümen, Myc. Univ., 1806.

Finland: Mustiala, *P. A. Karsten,* type distribution, in de Thümen, Myc. Univ., 1806.

Louisiana: St. Martinville, *A. B. Langlois, 2639* in part.

16. **C. flava** Burt, n. sp.

Type: in Burt Herb. and N. Y. Bot. Gard. Herb.

Fructification effused, soft, membranaceous, separable from the substratum, drying primuline-yellow throughout, with the margin a little paler; hymenium even, cracked, somewhat pulverulent; in structure 400 μ thick (1) with the hyphae loosely interwoven next to the substratum, 3–4½ μ in diameter, occasionally nodose-septate, frequently more or less incrusted, and (2) with the hyphae more densely arranged in the subhymenium, more regularly incrusted, and containing many heavily incrusted, cylindric cystidia 8–9 μ in diameter, which do not protrude beyond the surface of the hymenium; hymenial cystidia usually not incrusted, 5–7 μ in diameter, emerging up to 30 μ, occasionally with a few incrusting granules near the base; spores concolorous with the hyphae and the fructification, borne 4 to a basidium, even, flattened or slightly curved on one side, 4×2 μ.

Fig. 16 C. flava. Protruded part of cystidium, *c;* incrusted cystidium from interior of fructification, *d;* spores, *s.* × 665.

The portion of a fructification which I have seen is 1½×1 cm.

Substratum not noted. Jamaica. January.

Although I have seen but a small portion of a fructification, which does not afford data as to margin or substratum, this portion shows a species which should be readily recognized by its bright yellow color throughout, peeling away from the substratum in a compact sheet, small spores flattened on one side, and by heavily incrusted, wholly buried cystidia.

Specimens examined:

Jamaica: Troy and Tyre, Cockpit Country, 2000 ft. altitude, *W. A. Murrill & W. Harris,* N. Y. Bot. Gard., Fungi of Jamaica, 1089.

17. **C. laeticolor** Karsten, Finl. Basidsv. 436. 1889; Massee, Linn. Soc. Bot. Jour. **25**: 137. 1889.

Xerocarpus laeticolor Karsten, Finska Vet.-Soc. Bidrag Natur och Folk **37** : 137. 1882; Soc. pro Fauna et Flora Fennica Meddel. **9** : 52. 1883.—*Corticium laeticolor* (Karst.) Sacc. Syll. Fung. **6** : 636. 1888.—*Coniophora crocea* Karsten, Rev. Myc. **9** : 10. 1887 (this synonym published by Karsten); Soc. pro Fauna et Flora Fennica Meddel. **14** : 83. 1888; Sacc. Syll. Fung. **6** : 651. 1888; Massee, Linn. Soc. Bot. Jour. **25** : 137. 1889.

Type: authentic specimen of *C. crocea* in Burt Herb.

Fig. 17
C. laeticolor.
Section showing hyphae, cystidium, basidia, spores. × 665.

Fructification effused, adnate, indeterminate, drying raw sienna, the margin of the same color, thinning out; hymenium even, compact, somewhat pulverulent; in structure 60–120 μ thick, with the hyphae giving their bright color to the fructification, not incrusted, occasionally nodose-septate, 3–4 μ in diameter, ascending more or less densely from the substratum to the hymenial surface; cystidia cylindric, not incrusted, simple, or few-septate, 4–4½ μ in diameter, emerging 20–60 μ; spores concolorous with the hyphae, even, flattened on one side or slightly curved, 6–7×2½–3 μ.

Fructifications 4 cm. long, 2–2½ cm. broad.

On badly decayed, coniferous wood. Elkmont, Tennessee. September. Probably rare.

This species suggests by its bright color and thin, adnate habit the conidial stroma of some species of *Hypoxylon*, and it may have been overlooked heretofore on account of this resemblance. It is well marked by its bright color, thin and compact habit of growth, small, slender spores, and cystidia.

Specimens examined:

Finland: Mustiala, *P. A. Karsten,* under the name *Coniophora crocea.*

Tennessee: Elkmont, *C. H. Kauffman, 70* (in Mo. Bot. Gard. Herb., 16397).

18. C. byssoidea (Pers.) Fries, Hym. Eur. 659. 1874 (in subg. *Coniophora*); Karsten, Finska Vet.-Soc. Bidrag Natur och Folk **37** : 160. 1882; Sacc. Syll. Fung. **6** : 652. 1888.

Thelephora byssoides Persoon, Syn. Fung. 577. 1801; Fries, Syst. Myc. **1** : 452. 1821.—*Corticium* (subg. *Coniophora*) *byssoideum* (Pers.) Fries, Hym. Eur. 659. 1874.—*Coniophorella byssoidea* (Pers.) Bresadola, Ann. Myc. **1** : 111. 1903; Sacc. Syll. Fung. **17** : 183. 1905.—*Peniophora byssoidea* (Pers.) v. Höhn. & Litsch. K. Akad. Wiss. Wien Sitzungsber. **117** : 1084. 1908.—*Diplonema sordescens* Karsten, Finl. Basidsv. 430. 1889.—*Peniophora sordescens* (Karst.) Sacc. Syll. Fung. **9** : 240. 1891.

Fructification effused, dry, at first flaxy and hypochnoid, at length compact at the disk, drying cream-color to Naples yellow, the margin flaxy; hymenium even, tomentose; in structure 150–350 μ thick, composed of very loosely interwoven, rigid, nodose-septate hyphae 3–4 μ in diameter, which give the color to the fructification; cystidia slender, tapering, sharp-pointed, non-incrusted hairs, frequently nodose-septate, concolorous with the hyphae, 3–4½ μ in diameter, emerging up to 20–60 μ; spores concolorous with the hyphae but sometimes nearly hyaline under the microscope ,even, 4–4½×2½–3 μ, perhaps larger in spore collections.

Fig. 18
C. byssoidea.
Hypha bearing cystidium and basidia; spores. × 665.

Fructifications ranging from 1 to 6 cm. in diameter, or perhaps larger.

On wood and objects on the ground and running over the humus in pine woods. Canada to Louisiana and westward to British Columbia and Oregon, also in Jamaica; apparently very common in the northwest. June to December.

If one does not overlook the pale color of the small spores, this species is easily recognized, for in *Coniophora* it is noteworthy among all species of the genus by its bright color—

cream-color to Naples yellow throughout—hypochnoid structure, rather stiff, loosely arranged, nodose-septate hyphae, and slender septate cystidia frequently nodose-septate.

Specimens examined:

Exsiccati: Cooke, Fungi Brit., ed. 2, 607, under the name *Corticium sulphureum;* Krieger, Fungi Sax., 363.

Finland: Mustiala, *P. A. Karsten,* authentic specimen of *Diplonema sordescens.*

Sweden: *L. Romell, 78, 79;* Stockholm, *L. Romell, 110, 111, 236.*

Germany: Saxony, Königstein, *W. Krieger,* in Krieger, Fungi Sax., 363.

Austria-Hungary: *G. Bresadola.*

England: in Cooke, Fungi Brit., ed. 2, 607, under the name *Corticium sulphureum.*

Canada: locality not given, *J. Macoun, 10* in part, *15, 22;* Lower St. Lawrence Valley, *J. Macoun, 39, 59, 61.*

Ontario: Ottawa, *J. Macoun, 142, 143.*

Vermont: Middlebury, *E. A. Burt,* two collections.

Connecticut: New Haven, *G. P. Clinton.*

New York: Fall Creek, *G. F. Atkinson, 7994;* Freeville, *G. F. Atkinson, 2589.*

Florida: locality not given, *W. W. Calkins;* Jacksonville, *R. A. Harper, 1, 2, 3, 11* (in Mo. Bot. Gard. Herb., 54527–54530 respectively).

Louisiana: De Ridder, *C. J. Humphrey, 2527* (in Mo. Bot. Gard. Herb., 12532); St. Martinville, *A. B. Langlois, di, j.*

Michigan: Michigamme, *C. J. Humphrey, 1455* (in Mo. Bot. Gard. Herb., 22972).

Montana: Birch Creek, Beaverhead National Forest, *C. J. Humphrey, 2553* (in Mo. Bot. Gard. Herb., 9524).

Idaho: Coeur d'Alene, *J. R. Weir, 623* (in Mo. Bot. Gard. Herb., 13853); Priest River, *J. R. Weir, 132, 343* (in Mo. Bot. Gard. Herb., 15761, 21363).

British Columbia: Kootenai Mountains, near Salmo, *J. R. Weir, 518, 537, 623, 448, 475, 483, 492, 505, 504* in part, *486* (in Mo. Bot. Gard. Herb., 19420, 1737, 13853, 8836, 20977, 21979, 21982, 2096, 14169, 20226 respectively); Sidney,

J. Macoun, 26 in part, *27* (in Mo. Bot. Gard. Herb., 5681, 8934); Vancouver Island, *J. Macoun,* comm. by J. Dearness, V 186 (in Mo. Bot. Gard. Herb., 20183).

Oregon: Joseph, *C. L. Shear, 1037.*

Jamaica: Cinchona, *W. A. & Edna L. Murrill,* N. Y. Bot. Gard., Fungi of Jamaica, 459.

19. **C. olivascens** (Berk. & Curtis) Massee, Linn. Soc. Bot. Jour. **25** : 138. 1889.

Corticium olivascens Berk. & Curtis, Grevillea **1** : 179. 1873; Sacc. Syll. Fung. **6** : 619. 1888.—*Corticium prasinum* Berk. & Curtis, Grevillea **1** : 179. 1873; Sacc. Syll. Fung. **6** : 619. 1888; Massee, Linn. Soc. Bot. Jour. **27** : 153. 1890.—*Coniophora prasina* (Berk. & Curtis) v. Höhn. & Litsch. K. Akad. Wiss. Wien Sitzungsber. **116** : 781. 1907. — *Corticium chlorinum* Berk. & Curtis, Grevillea **1** : 179. 1873; Sacc. Syll. Fung. **6** : 636. 1888; Massee, Linn. Soc. Bot. Jour. **27** : 154. 1890.—*Coniophora subochracea* Peck, N. Y. State Mus. Rept. **50** : 114. 1897; Sacc. Syll. Fung. **14** : 225. 1899.

Type: type and cotype in Kew Herb. and Curtis Herb. respectively.

Fig. 19
C. olivascens.
Protruded part of cystidium, spores, and hypha, × 665; section showing cystidia on a granule × 45.

Fructification effused, dry, adnate, drying olive-lake to olive-citrine, the subiculum and margin whitish, floccose; hymenium even or minutely granular, more or less cracked; in structure 200–400 μ thick, with the granules rising up to 200 μ more, composed of hyaline, thin-walled, often collapsed, nodose-septate hyphae 3–5 μ in diameter, loosely interwoven, sometimes with rope-like hyphal strands near the substratum; granules dome-shaped, bearing hair-like cystidia scattered or in small clusters, not incrusted, often nodose-septate, 4–5 μ in diameter, emerging up to 60 μ; spores Isabella-color in a spore collection, even, 4–6×3–4 μ, mostly 5×3½ μ.

Fructifications 1½–3 cm. long, 1–2 cm. broad.

On coniferous bark and wood on the ground and on palmetto. Ontario to Louisiana, and in Cuba and the Bahama Islands. July to April.

C. olivascens is distinguished by its olivaceous color varying by intermediate shades to almost bottle-green, by its small spores, and by having hair-like cystidia protrude from its granules, frequently in clusters, as in the genus *Odontia.* The granular hymenial surface appears to be more frequent in northern collections than in those from the south, and the hyphae are more abundantly nodose-septate in northern specimens. Occasionally a collection will fail to show cystidia in a set of sections, especially if the fructification is rather young, but examination of other sets of sections from the oldest and most granular portions of the fructification will eventually demonstrate cystidia. *Grandinia virescens.* Pk. is colored exactly like *C. olivascens* and has the same general habit, but the spores of *G. virescens* are darker and minutely aculeate when the fructification is fully mature.

Specimens examined:

Exsiccati: Ravenel, Fungi Car. **5**: 29.

Canada: Ottawa, *J. Macoun, 25.*

Ontario: Port Credit, *J. H. Faull, 321* (in Mo. Bot. Gard. Herb., 44945).

Massachusetts: Boston, *Murray,* cotype (in Curtis Herb., 6392).

New York: Albany, *H. D. House* (in Mo. Bot. Gard. Herb., 15946); East Galway, *E. A. Burt;* Ithaca, *G. F. Atkinson, 22977; C. J. Humphrey,* Cornell Univ. Herb., 22562; Karner, *H. D. House, 14.190, 14.169, and two unnumbered collections* (in Mo. Bot. Gard. Herb., 44718, 44720, 54363, 54364); Menands, *C. H. Peck,* type of *Coniophora subochracea* (in Coll. N. Y. State); Westport, *C. H. Peck* (in N. Y. State Mus. Herb. and in Mo. Bot. Gard. Herb.).

New Jersey: Newfield, *J. B. Ellis,* comm. by W. G. Farlow (in Mo. Bot. Gard. Herb., 44641).

Pennsylvania: Whitehaven, *G. F. Atkinson, 8653.*

Alabama: *Peters,* type distribution of *Corticium prasinum* in

Ravenel, Fungi Car. **5**: 29, and cotype (in Curtis Herb., 6080).

Louisiana: Abita Springs, *A. B. Langlois, 2639* in part; St. Martinville, *A. B. Langlois, u.*

Michigan: Ann Arbor, *C. H. Kauffman, 21.*

Bahama Islands: Nassau, *A. E. Wight,* comm. by W. G. Farlow.

Cuba: San Diego de los Banos, *Earle & Murrill, 334,* N. Y. Bot. Gard., Fungi of Cuba.

EXCLUDED SPECIES

C. capnoides Ell. & Ev. Phila. Acad. Nat. Sci. Proc. **1894**: 324. 1894; Sacc. Syll. Fung. **11**: 129. 1895.

Type: type distribution in Ell. & Ev., N. Am. Fungi, 2808.

This fungus bears its spores singly on conidiophores, as stated in the original description, and is not a basidiomycete.

C. sordulenta Cooke & Massee in Sacc. Syll. Fung. **6**: 650. 1888; Massee, Linn. Soc. Bot. Jour. **25**: 132. 1889.

Type: type in Kew Herb.

This species is not distinct from *Thelephora pallescens* Schw., whose relationship to *Hypochnus thelephoroides* (Ell. & Ev.) Burt was pointed out in my comment on the latter in Ann. Mo. Bot. Gard. **3**: 236. 1916. I have recently prepared a new set of sections from the authentic specimen of *Thelephora pallescens* Schw. in Curtis Herb. This specimen is in fine condition and shows the spores fully as rough-walled or aculeate in aqueous mounts as those of *Hypochnus thelephoroides,* which, therefore, becomes a synonym of *T. pallescens* and should be displaced in my account of our species of *Hypochnus* by the name *Hypochnus pallescens* (Schw.) Burt, with synonymy and distribution as follows:

26. Hypochnus pallescens (Schw.) Burt, n. comb.

Thelephora pallescens Schweinitz, Am. Phil. Soc. Trans. N. S. **4**: 167. 1832.—*Stereum pallescens* Schweinitz in Sacc. Syll. Fung. **6**: 586. 1888.—*Corticium pallescens* (Schw.) Massee, Linn. Soc. Bot. Jour. **27**: 129. 1890.—*Thelephora insinuans* Schweinitz, Am. Phil. Soc. Trans. N. S. **4**: 167. 1832.—

Stereum insinuans Schweinitz in Sacc. Syll. Fung. **6** : 586. 1888.—*Coniophora insinuans* (Schw.) Massee, Linn. Soc. Bot. Jour. **25** : 138. 1889.—*Corticium* (subg. *Coniophora*) *sordulentum* Cooke & Massee, Grevillea **16** : 69. 1888.—*Coniophora sordulenta* Cooke & Massee in Sacc. Syll. Fung. **6** : 650. 1888; Massee, Linn. Soc. Bot. Jour. **25** : 132. 1889.—*Corticium thelephoroides* Ell. & Ev. Jour. Myc. **1** : 88. 1885; Sacc. Syll. Fung. **6** : 630. 1888.—*Hypochnus thelephoroides* (Ell. & Ev.) Burt, Ann. Mo. Bot. Gard. **3** : 235. 1916.

Specimens examined:

Exsiccati: Ell. & Ev., N. Am. Fungi, 2020, under the name *Corticium dryinum;* Ell. & Ev., Fungi Col., 706, under the name *Corticium vagum;* Ravenel, Fungi Am., 719, under the name *Peniophora flavido-alba* (in copy of U. S. Dept. Agr. Herb.).

Canada: Cedar Hill, Van Island, *J. Macoun, 62.*

New Hampshire: Chocorua, *W. G. Farlow.*

Massachusetts: Sharon, *A. P. D. Piguet,* comm. by W. G. Farlow (in Farlow Herb. and in Mo. Bot. Gard. Herb., 54787).

New Jersey: Newfield, *J. B. Ellis,* in Ell. & Ev., Fungi Col., 706.

Pennsylvania: Bethlehem, *Schweinitz,* types of *Thelephora pallescens* and *Thelephora insinuans* (in Herb. Schw. and in Curtis Herb.).

Georgia: Darien, *H. W. Ravenel,* in Ravenel, Fungi Am., 719 (in copy of U. S. Dept. Agr. Herb.).

Florida: *W. W. Calkins,* U. S. Dept. Agr. Herb.; Jacksonville, *W. W. Calkins,* in Ell. & Ev., N. Am. Fungi, 2020; New Smyrna, *C. G. Lloyd, 2138.*

Louisiana: Lake Charles, *C. J. Humphrey, 2538* (in Mo. Bot. Gard. Herb., 12959); St. Martinville, *A. B. Langlois, az, c, u, y, 2633, 2673,* and a specimen comm. by C. G. Lloyd, 3017.

Texas: Houston, *H. W. Ravenel, 239,* U. S. Dept. Agr. Herb.

Illinois: Cerro Gordo, *L. O. Overholts, 3284* (in Mo. Bot. Gard. Herb., 10640).

Missouri: comm. by *J. B. Ellis, 5055,* type of *Corticium sordulentum* (in Kew Herb.).

Washington: *Carpenter, 90,* type of *Corticium thelephoroides* (in N. Y. Bot. Gard. Herb., Kew Herb., Farlow Herb., and Mo. Bot. Gard. Herb.).

British Columbia: Kootenai Mountains, near Salmo, *J. R. Weir, 497* (in Mo. Bot. Gard. Herb., 21978); Vancouver, *J. Macoun, V 178,* comm. by J. Dearness (in Mo. Bot. Gard. Herb., 8938).

Mexico: Colima, *W. A. & E. L. Murrill,* N. Y. Bot. Gard., Fungi of Mexico, 591 (in Mo. Bot. Gard. Herb.).

Jamaica: Morce's Gap, *W. A. & E. L. Murrill,* N. Y. Bot. Gard., Fungi of Jamaica, 658.

Cuba: Alto Cedro, *L. M. Underwood & F. S. Earle,* N. Y. Bot. Gard., Plants of Cuba, 1530; San Diego de los Banos, Pinar del Rio Province, *F. S. Earle & W. A. Murrill, 572,* N. Y. Bot. Gard.

Porto Rico: Rio Piedras, *J. A. Stevenson, 5794* (in Mo. Bot. Gard. Herb., 54691).

Trinidad: Arepo Lavanna, *R. Thaxter,* comm. by W. G. Farlow, 20.

(To be continued.)

ALGOLOGICAL NOTES

I. Chlorochytrium gloeophilum Bohlin

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In August, 1909, there was collected at Gosnold Pond, Cuttyhunk, Mass., *Rivularia Bornetiana* Setch., which grows abundantly there on *Chara* and attached to stems of sedges. Upon examination the gelatinous matrix of the *Rivularia* was found to be more or less filled with a unicellular grass-green alga, which apparently failed to fit the published descriptions of any known genus, and living material was obtained in the hope that the life history of this plant might be determined. For the past seven years material has been collected at various times during June, July, and August, and impure cultures maintained through the greater part of this time. It is believed, therefore, that the information derived from this rather prolonged study comprises as complete a knowledge as may be expected of the alga growing under the conditions stated. As will be seen, the affinities of the plant would lead one to expect some kind of a motile spore or gamete, and one reason for continuing the investigation over so many years was the belief that such a spore existed. None has been found, however, and while ciliated spores may be discovered later, it hardly seems probable.

It early became evident that the published description most nearly corresponding with the form found in Gosnold Pond was *Chlorochytrium gloeophilum* growing in colonies of *Rivularia*, described by Bohlin[1] from preserved material from Paraguay. An exact copy of all the information furnished concerning this plant follows:

"1. **Chlorochytrium gloeophilum** n. sp. Tab. 1, Fig. 53, 54.
Chl. cellulis ovato-oblongis, membrana hyalina, in uno vel utroque polo incrassata. In coloniis Rivulariarum nidulans.

[1] Bohlin, K. Die Algen der ersten Regnell'schen Expedition. I. Protococcoideen. K. Svenska Vet.-Akad., Bihang till Handl. III. 23^7: 28. *pl. 1. f. 53.* 1897.

Long. cell. 20–35, lat. cell. 8–18 μ.
Paraguay (86).
Möglicherweise könnte diese kleine Alge zu der Gattung *Kentrosphaera* Borzi gehören. Die Gestalt der Chromatophoren war nicht völlig zu erkennen. Die Wandverdickung des einen Zellendes und die Lebensweise sprechen nicht gegen eine solche Ansicht."

Presumably upon the basis of this last statement, since there is no indication of his having seen the plant, Brunnthaler[1] removes the species to *Centrosphaera,* publishing it as *Kentrosphaera gloeophila* (Bohlin) Brunnthaler, with the original description except that the measurements are given as "20–25 μ breit, 20–30 μ lang." This is apparently an error, since the figure published is copied from Bohlin's and is twice as long as wide. The habitat is likewise erroneously given as *R. nidulans.* As will be seen from the above original description, what Bohlin actually said was "in coloniis Rivulariarum nidulans," thus furnishing a most interesting example of the way in which names creep into the literature, as well as emphasizing the necessity of referring to the original in order to get accurate information.

The cell of what may be regarded as the normal vegetative condition of the alga found growing in *R. Bornetiana* measures from 25 to 30 μ in diameter, and is practically a perfect sphere. Later on, at the time of spore formation or because of the very considerable thickening of the wall and excrescences which may be formed, the dimensions vary very considerably, cells 50×25 μ, 70×35 μ, and in one instance 88×40 μ having been observed. In the latter case, however, exclusive of the thickened wall, the measurements were 64×25 μ.

There is a single chloroplast which lies close to the wall and usually lines the entire cell (pl. 18, figs. 2–4). Occasionally the chloroplast is incomplete, producing a light spot of varying size (pl. 18, fig. 1.) One large and prominent pyrenoid is always present, and a single nucleus, either centrally or laterally placed, may be made out by staining. At no time,

[1] Brunnthaler, J. Protococcales. In Pascher's Die Süsswasser-Flora Deutschlands, Österreichs und der Schweiz, Heft 6: 67–68. *f. 5–6.* 1915.

either in the vegetative cell or sporangium, is there the slightest indication of the radial arrangement of the chloroplast which is supposed to be characteristic of *Centrosphaera* and which Bohlin apparently considered necessary before placing his Paraguay plant in this genus. On this point Borzi[1] says:

> "La cavitá cellulare é ripiena di un protoplasma ablondante di chlorofilla differenziata in numerosi cordoni cilindrici, ora dritti, ora leggermente sinuosi, elegantémente disposti a raggio intorno al centro della cellula, dal quale si allontanano un po' lasciandovi scoperta un'area circolare scolorata."

Brunnthaler[2] in his characterization of *Centrosphaera* states of the chloroplast: "Chromatophor grün oder gelblichgrün, wandständig, aus zahlreichen Körnern oder bandförmigen Strahlen bestehend, welche gegen das Zentrum der Zelle gerichtet sind und die Mitte freilassen." This is obviously an expansion of the genus for the purpose of admitting *C. gloeophila,* the chloroplast of which shows clearly in Bohlin's figure (although somewhat plasmolized) that it in no way approaches the arrangement specified by Borzi, but is made up of numerous granules. One might well question the propriety of such a procedure, particularly since plants were not available for examination. I am accordingly not inclined to accept this disposition of Bohlin's plant or of the one collected at Cuttyhunk—which are undoubtedly the same thing—particularly since the present tendency, according to West,[3] is to combine under *Chlorochytrium* a number of genera such as *Endophaera, Scotinosphaera, Chlorocystis,* and *Stomatochytrium,* the distinguishing characteristics of which are trivial or uncertain. The name should therefore stand, in my opinion, as *Chlorochytrium gloeophilum* Bohlin (*Centrosphaera gloeophilum* (Bohlin) Brunnthaler).

After the vegetative cell of *C. gloeophilum* matures, the wall almost invariably thickens until it is from 5 to 10 μ thick. This is independent of the peculiar excrescences or irregular outgrowths which may be more than half the length of the

[1] Borzi, A. Studi Algologici 1 : 90. 1883.
[2] Loc. cit.
[3] West, G. S. Algae 1 : 212. Cambridge, 1916.

cell itself. While these localized growths of the wall are usually external (pl. 18, figs. 2–4), they may likewise be internal (pl. 18, fig. 6), and although both the wall and these growths usually show a characteristic lamellate structure they may be entirely homogeneous.

Calcium oxalate crystals were infrequently observed within the cell (pl. 18, fig. 14).

The only type of reproduction observed was by aplanospores, which are freely formed throughout the growing season. These may be produced in cells which are circular in outline, but usually the sporangium is formed from a cell which is considerably longer than broad and on the wall of which a distinct excrescence has formed. The aplanospores are produced by successive division (pl. 18, figs. 7–11), and usually number from 32 to 64 in each sporangium. They are practically spherical and measure about 4 μ in diameter. By the time the aplanospores are completely formed there is frequently produced a distinct opening in the sporangium wall quite large enough to permit the escape of the spores. This opening may occur at any place in the wall but has occasionally been observed at the end of a tubular extension of the cell (pl. 18, fig. 12). Generally it is a distinct pore produced by the dissolution of the wall at that point but at times a considerable portion of the wall may be cut out and turned back in an irregular manner, suggesting somewhat the method of spore liberation in *Chlorocystis* (pl. 18, fig. 13). In spite of this provision for the escape of the spores, they rarely take advantage of it—in fact any aplanospores which leave the sporangium through the opening provided appear to have done so entirely by accident.

Usually the spores remain clustered together in about the position in which they were formed. As they increase in size the old sporangium wall disintegrates, and the new plants are gradually distributed through the gelatinous matrix of the *Rivularia* by the formation of new filaments of the blue-green and the action of such forces in the water as would be calculated to break up the original arrangement. The very definite provision for a means of escape for the spores sug-

gests that possibly *Chlorochytrium gloeophilum* originally possessed a motile spore, but that owing to the habitat adopted, in which a ciliated spore would be unable to swim, the cilia were lost. It was originally assumed that the plants at some stage in their existence left the *Rivularia,* and that ciliated spores would afford an easy means of again establishing themselves in the gelatinous colonies. This does not seem to be the case, however. The Chlorochytrium cells apparently never give up their endophytic habit, and new colonies of *Rivularia* are infected from aplanospores contained in the gelatin surrounding the young filaments which increase with the development of the Rivularia colony.

With the idea that possibly *C. gloeophilum* might occur in other species of *Rivularia* the following forms were examined from exsiccati: Rabenhorst, 295, *R. minor;* 355, *R. pygmaea;* 416, *R. minuta;* 648, *R. angulosa;* 743, *R. minuta;* 793, *R. Sprengeliana;* 931, *R. angulosa;* 932, *R. Lyngbyana;* 975, *R. Lenticula;* 976, *R. durissima;* 1095, *R. minuta;* 1125, *R. Sprengeliana;* 1452, *R. insignis;* 2184, *R. villosa;* 2540, *R. fluitans;* 2563, *R. terebralis.* Collins, Holden, and Setchell, 357, *R. atra;* 358, *R. Biasolettiana;* 260, *R. nitida;* 508, *R. compacta;* 860, *R. Biasolettiana;* 1015, *R. polyotis.* Tilden, 166, *R. Biasolettiana;* 289, *R. haematites;* 570, *R. Biasolettiana;* 571, *R. nitida.* In no case was there the slightest indication of the presence of the endophyte.

Specimens of the following included in the Missouri Botanical Garden Herbarium were also examined, but with negative results: *Rivularia nitida, R. bullata, R. fluitans, R. atra,* as well as several undetermined species. In view of the fact that none of these specimens showed the presence of *C. gloeophilum,* it is interesting to note that the specimen of *R. Bornetiana* from Watch Hill Pond, Watch Hill, R. I., distributed as No. 157 in Collins, Holden, and Setchell's 'Phycotheca,' contained an abundance of grass-green cells within the gelatinous matrix, which was easily recognized as *C. gloeophilum.* Hence at the only two localities thus far noted in the United States for *R. Bornetiana, C. gloeophilum* is found growing within it and apparently in no other species.

Bohlin did not give the species of *Rivularia* in which his plant was found and there is no way of telling whether it was *R. Bornetiana* or not.

A set of *C. gloeophilum* has been prepared from the Collins, Holden, and Setchell 'Phycotheca' and will be distributed during the year 1918.

Explanation of Plate

PLATE 18

All figures are reproduced from camera drawings × 580.

Fig. 1. Typical cell with chloroplast only partially lining the wall.

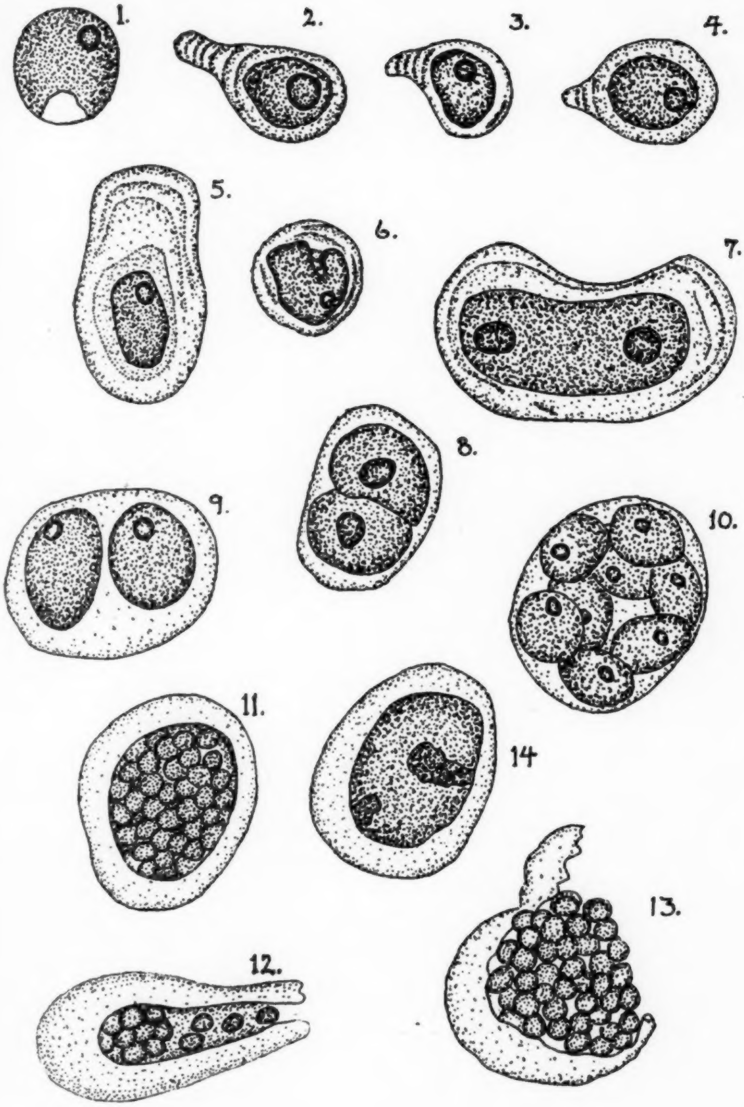
Figs. 2–5. Various examples of irregularities in thickened wall.

Fig. 6. Internal thickening of wall penetrating cell.

Figs. 7–11. Successive stages in the formation of spores.

Figs. 12–13. Means of spore liberation.

Fig. 14. Calcium oxalate crystals formed in cell.



MOORE—CHLOROCHYTRIUM GLOEOPHILUM

STUDIES IN THE PHYSIOLOGY OF THE FUNGI

V. The Growth of Certain Fungi in Plant Decoctions

B. M. DUGGAR, J. W. SEVERY, AND H. SCHMITZ

In a previous paper attention has been drawn by the writers[1] to the growth relations of certain fungi in a few plant decoctions with and without additional nutrients. In the continuation of this work much the same methods have been followed, but the number of fungi employed has been reduced to two, the one, *Aspergillus niger*, being taken as a representative of saprophytic species, and the other, *Gloeosporium* (*Glomerella*) *Gossypii* as a representative of parasitic forms.

Besides the decoctions previously employed, namely, bean, sugar beet, prune, potato, turnip, and corn meal, there have been used also decoctions of apple, mangold (mangel-wurzel), celery, carrot, and salmon. Basing the decoctions as before on 50 grams of the dry weight of the material used per liter of water, the fresh weight quantities of the additional materials involved were as follows: apple, 294.1 gm.; carrot, 438.2 gm.; mangold, 546.4 gm.; and celery, 333.3 gm. In the case of the salmon it was not practicable to determine the amount of material required on a dry-weight basis, so that one can, 15½ oz. (439.4 gm.) net, was used for a liter of water. As far as possible the oil or fat was eliminated. In the case of the celery untrimmed bunches were employed. In each instance the product was cut into small pieces, a liter of water added to the required green weight of product, and this was steamed for one hour at 15 pounds in an autoclave, then filtered hot through Canton flannel, and finally made up to the proper volume. After stock flasks were arranged the solutions were autoclaved for 20 minutes at 15 pounds pressure. Titrations of these decoctions showed the following reaction in terms of Fuller's scale: apple, +14.5; carrot, +14.5; celery, +10.5; mangold, +15; and salmon, +43. As mentioned later, however, little weight is attached to these values.

[1] Duggar, B. M., Severy, J. W., and Schmitz, H. Studies in the physiology of the fungi. IV. The growth of certain fungi in plant decoctions. Ann. Mo. Bot. Gard. 4: 165–173. *f. 1–4*. 1917.

In combining other nutrients with the standard decoctions it is impracticable to make the various solutions in a series entirely comparable. It has seemed that the greater error would result from any attempt to prepare a double-strength decoction, to be diluted with a solution of the nutrients introduced; so it was determined to add to the decoction the various nutrients in solid form. This necessarily increased slightly the volume of the solution. The slight excess over the correct volume was, however, discarded, since any increase of volume would diminish the area of the flask. Some few tests, as indicated in tables I and II, required the dilution of the decoction to one-half. In every case the volume of culture medium in each Erlenmeyer flask was 25 cc., the cultures were made in duplicate, and in certain instances parts of a series

TABLE I

GROWTH OF ASPERGILLUS NIGER ON VARIOUS DECOCTIONS WITH AND WITHOUT OTHER NUTRIENTS

Culture medium	Dry weight in grams				
	Apple	Mangold	Carrot	Celery	Salmon
1 Natural decoction	.019	.178	.052	.085	.094
1a Standardized dec't. (to + 15 Fuller's scale)	....	....	....	.075	.066
2 Nat'l. dec't. + 13.68% sugar	.038	.259	.077	.489	.863
3 Nat'l. dec't. + 13.68% sugar +1% KNO_3	.311	.319	.679	.946	1.063
4 Nat'l. dec't. + 1% KNO_3	.145	.232	.144	.080	.075
5 Nat'l. dec't. +13.68% sugar + .5% KH_2PO_4	.046	.309	.119	.489	.768
6 Nat'l. dec't. + .5% KH_2PO_4	.021	.233	.051	.076	.117
6a Nat'l. dec't. + 1% KH_2PO_4	.022	.240	....	....	....
7 Nat'l. dec't. + 13.68% sugar +1% KNO_3 +.5% KH_2PO_4	.462	1.016	.922	1.257	1.028
8 Nat'l. dec't. +1% KNO_3 +.5% KH_2PO_4	.221	.304	.151	.079	.085
9 ½ nat'l. dec't. and ½ Richards' sol.*	.445	.547	.537	.699	.738
10 ½ nat'l. dec't. and ½ distilled water	.016	.104	.028	.036	.037
½ nat'l. dec't. and ½ Richards' sol	.472	.476	.455	....	.469
½ nat'l. dec't. and ½ ash sol	.025	.137	.034	....	.057
Nat'l. dec't. + .25% $MgSO_4$ + 13.68% sugar	.034	....	....	....	....
Nat'l. dec't. brought to 10^{-6} with NaOH	....	.235	....	....	....
Nat'l. dec't. brought to 10^{-6} with K_2HPO_4	....	.239	....	....	....

* The nutrient solution designated Richards' solution in these tables is made up as follows: KNO_3 1 gm., KH_2PO_4 .5 gm., $MgSO_4$ .25 gm., sugar 5 gm., distilled water 100 cc.

were repeated. The manipulation of the cultures, dry-weight determinations, etc., were exactly as described in our previous paper.

The complete results of these series are given in tables I, II, and III, and most of these data are shown graphically in figs. 1–5. These curves are based primarily on the relations of

TABLE II

GROWTH OF GLOEOSPORIUM GOSSYPII ON VARIOUS DECOCTIONS WITH AND WITHOUT OTHER NUTRIENTS

Culture medium	Dry weight in grams				
	Apple	Mangold	Carrot	Celery	Salmon
1 Natural decoction	.049	.241	.123	.071	.135
1a Standardized dec't. (to + 15 Fuller's scale)	....	....	....	.072	.111
2 Nat'l. dec't. + 13.68% sugar	.059	.379	.344	.817	.596
3 Nat'l. dec't. + 13.68% sugar + 1% KNO_3	.333	.330	.561	.689	.730
4 Nat'l. dec't. + 1% KNO_3	.223	.195	.153	.073	.160
5 Nat'l. dec't. + 13.68% sugar + .5% KH_2PO_4	.171	.444	.283	.912	.653
6 Nat'l. dec't. + .5% KH_2PO_4	.085	.281	.149	.104	.163
6a Nat'l. dec't. + 1% KH_2PO_4	.040	.279	....	....	....
7 Nat'l. dec't. + 13.68% sugar + 1% KNO_3 + .5% KH_2PO_4	.395	.835	.533	.748	.552
8 Nat'l. dec't. + 1% KNO_3 + .5% KH_2PO_4	.216	.348	.164	.099	.131
9 ½ nat'l. dec't. and ½ Richards' sol	.470	.581	.485	.497	.535
10 ½ nat'l. dec't. and ½ distilled water	.038	.158	.073	.047	.096
½ nat'l. dec't. and ½ Richards' sol	.551	.492	.513	....	.509
½ nat'l. dec't. and ½ ash sol	.044	.134	.032	....	.098
Nat'l. dec't. + .25% $MgSO_4$ + 13.68% sugar	.126	....	....	....	....
Nat'l. dec't. brought to 10^{-6} with NaOH	....	.209	....	....	....
Nat'l. dec't. brought to 10^{-6} with K_2HPO_4	....	.284	....	....	....

the different cultures containing the decoctions, but for comparison half-strength and full-strength Richards' solution, also Richards' solution containing 13.68 per cent sugar, are included.

In the tables the numerals at the left of the various culture solutions correspond to those in the legends of the figures, and therefore a fuller explanation of the figures is afforded by referring to the tables. The addition of sugar and other nutrients to the decoctions (or other solutions) is expressed

in the tables by the plus sign, and is to be interpreted that the decoction is used as solvent and contains those amounts. Where two solutions are mixed half the quantity of each is employed, so that the resulting medium is half strength with respect to each.

TABLE III

ASPERGILLUS AND GLOEOSPORIUM ON RICHARDS' SOLUTION AND MODIFIED DECOCTIONS

	Culture medium	Dry weight in gms.	
		Aspergillus	Gloeosporium
11	½ Richards' sol. and ½ distilled water	.424	.202
12	Richards' sol	.587	.343
13	Modified Richards' sol. to contain 13.68% sugar + .5% K_2HPO_4	.842	.369
	Modified Richards' sol. to contain 13.68% sugar + .25% K_2HPO_4 + .25% KH_2PO_4	.755	.522
	½ nat'l. bean dec't. and ½ Richard's sol	.457	.542
	½ nat'l. bean dec't. and ½ bean dec't. ash sol	.043	.044
	½ nat'l. prune dec't. and ½ Richards' sol	.456	.517
	½ nat'l. prune dec't. and ½ prune dec't. ash sol.	.070	.082
	½ nat'l. sugar beet dec't. and ½ Richards' sol	.437	.498
	½ nat'l. turnip dec't. and ½ Richards' sol	.455	.501
	½ nat'l. turnip dec't. and ½ turnip dec't. ash sol	.044	.051

Naming the decoctions in the order of the best growth as determined by the criterion of weight the series for *Aspergillus* is as follows: mangold, salmon, celery, carrot, and apple; while for *Gloeosporium* the same order prevails except that celery and carrot exchange places. The mangold is relatively rich in sugar, and this perhaps explains the higher growth quantities in the decoction of this product as compared with the other native decoctions mentioned. The addition of sugar alone to mangold decoction, as might be expected, gives very little more growth than the addition of one of the mineral nutrients. With the addition of sugar alone to the various decoctions *Aspergillus* shows the greatest increase in salmon decoction, about 900 per cent, the celery medium exhibiting the next greater increase; while with *Gloeosporium* the order of these two higher is reversed. The marked increase in growth in salmon decoction with the addition of sugar is a clear indication that this substratum is well provided with the other essential nutrients. The general appearance of the curves indicating the yields in celery solutions

demonstrates a fairly close agreement with the curves for salmon solutions.

It is interesting to note that while *Aspergillus* makes a heavier growth in decoctions plus sugar and mineral nutrients (except in the case of apple) than in the Richards' solution

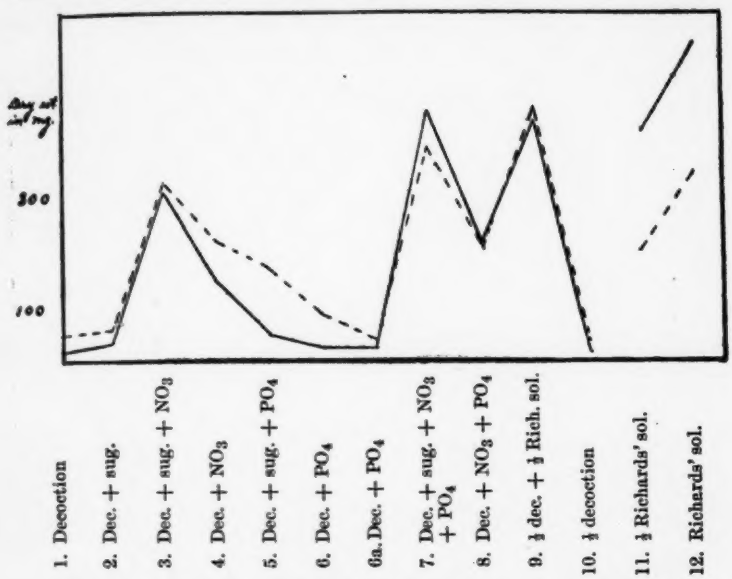


Fig. 1. Growth of *Aspergillus* and *Gloeosporium* on apple decoction and other nutrients; *Aspergillus*, solid line; *Gloeosporium*, broken line.

containing the same amount of sugar, still the differences are scarcely as great as might be expected, taking into consideration the fact that the decoction is a complex food solution. That the solution containing apple decoction, sugar, etc., yields less growth than the Richards' solution is noteworthy. With *Gloeosporium* obviously the Richards' solution is not as satisfactory as the decoction-containing solutions, but as yet there is no evidence as to the nature of the nutrients lacking in the former.

In table III ash solutions of several decoctions are mentioned. These were prepared by drying down 25 cc. (for two cultures) of each decoction, then carefully incinerating. This

ash was then dissolved or diffused in 25 cc. of water and combined with the decoction. In all cases this addition of mineral constituents gave slightly increased yield.

Aspergillus fruited well in the great majority of cultures. In the mangold solutions some depression of fruiting occurred

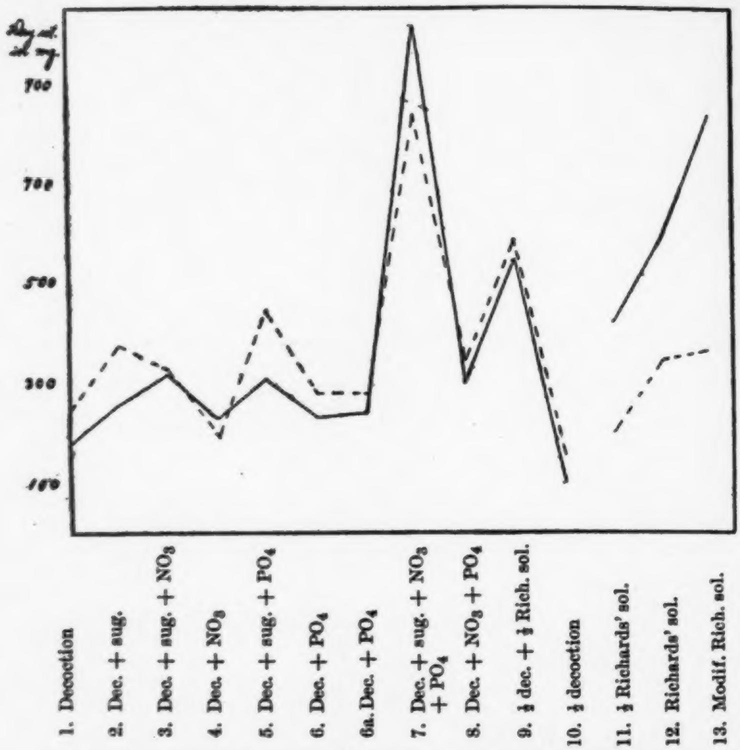


Fig. 2. Growth of *Aspergillus* and *Gloeosporium* on mangold decoction and other nutrients; *Aspergillus*, solid line; *Gloeosporium*, broken line.

where the nutrients were less well balanced, as where sugar and nitrate or sugar and phosphate alone were added. Much the same effect was noted in the carrot and celery decoctions, though here it was less pronounced. While spore production was considerable on the various salmon cultures, the general appearance of the fruiting surface was gray rather than black.

This seemed to be due not only to the smaller number of spores, but also to lesser pigmentation.

Gloeosporium yielded a heavy gelatinous growth upon most of the media containing mangold, celery, and carrot decoctions, but there were considerable differences in the amounts

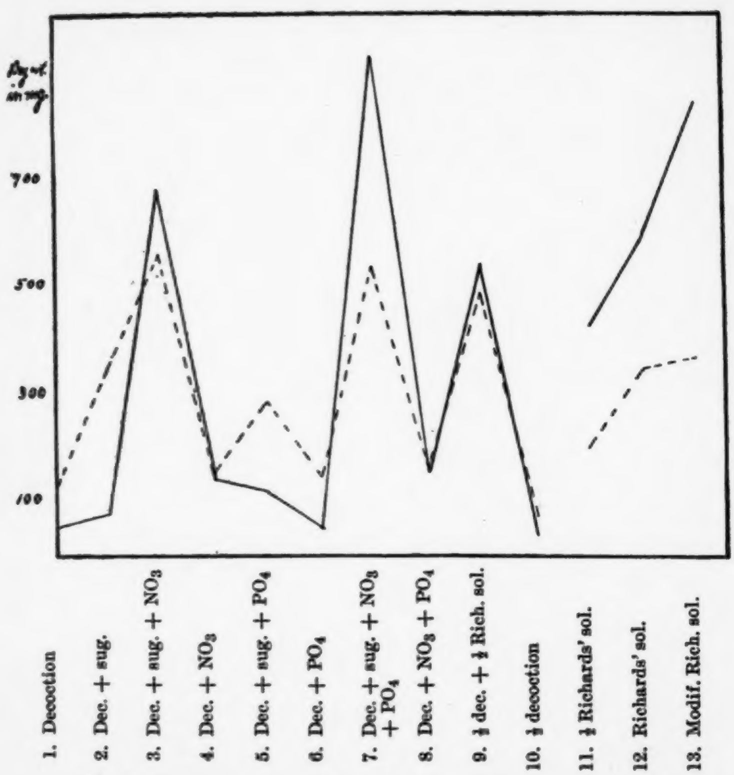


Fig. 3. Growth of *Aspergillus* and *Gloeosporium* on carrot decoction and other nutrients; *Aspergillus*, solid line; *Gloeosporium*, broken line.

of spore formation. The media containing carrot decoction gave abundant fruiting when sugar was added in the presence of nitrate, and less in all other cultures. On the celery-containing solutions there was less difference in the amount of fruiting observed, and the mangold was intermediate in this

respect. This fungus also fruited scarcely at all on the salmon decoction alone or even when one or more of the mineral

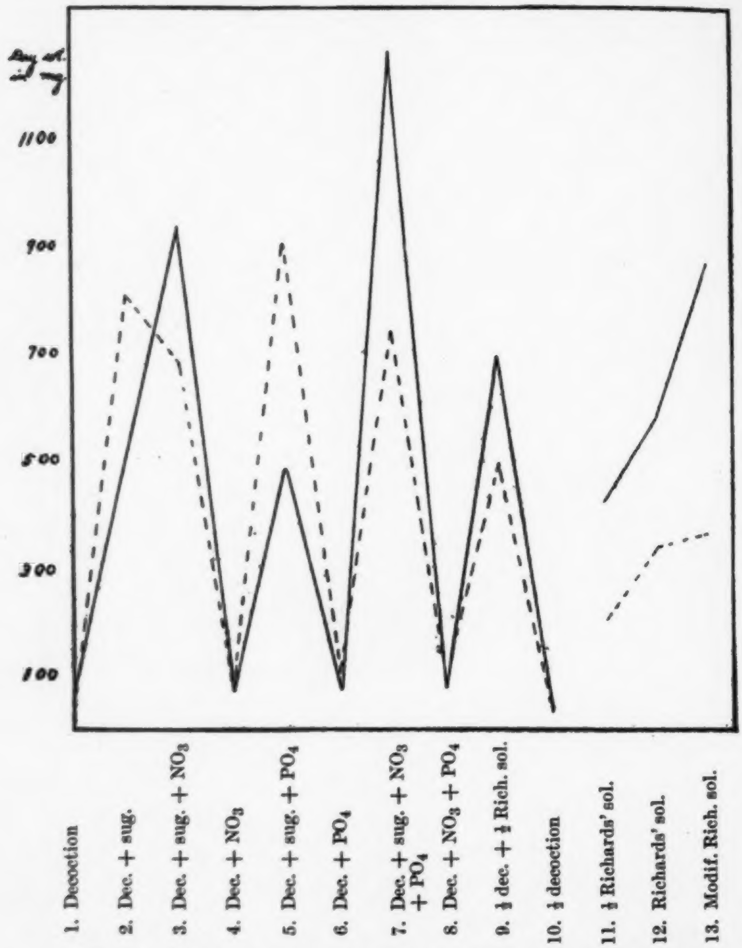


Fig. 4. Growth of *Aspergillus* and *Gloeosporium* on celery decoction and other nutrients; *Aspergillus*, solid line; *Gloeosporium*, broken line.

nutrients were added to the decoction, yet fruiting was most abundant in all the cultures to which sugar was added without nitrogen. This is of interest in connection with the in-

dication that the addition of nitrogen to the salmon decoction does not materially influence growth.

In this paper the criterion by which the value of a solution is judged is that of the weight of mycelium produced.

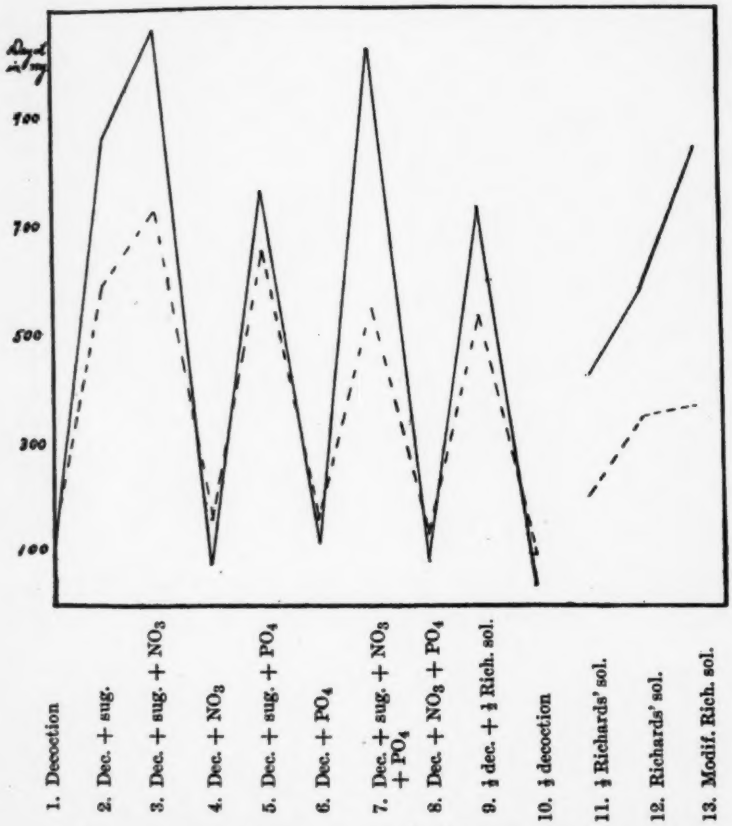


Fig. 5. Growth of *Aspergillus* and *Glœosporium* on salmon decoction and other nutrients; *Aspergillus*, solid line; *Gloeosporium*, broken line.

This is a practical criterion for general purposes, but the pathologist is particularly interested in "normal" growth, which often means considerable growth and abundant fruiting. Any data, therefore, which bear upon the relation of

nutrition to fruiting are worthy of consideration. *Aspergillus* fruits so readily that experiments with this form might seem to be of little value, yet knowledge concerning factors effecting an inhibition of fruiting is likewise important. Richards[1] and others have shown that associated with the increased growth resulting from the addition of $ZnSO_4$ and certain other metallic salts is the depression of fruiting. Numerous observations of this general nature might be collected.

In this paper it is not intended to enter upon a general discussion of nutrients affecting spore production. It has seemed, however, that the influence upon spore formation of such variations in nutrient conditions as have been studied are worthy of record, and it is intended to pursue further this line of inquiry in subsequent work, for which fungi better adapted to the purpose have been selected.

In our previous paper it was pointed out that even a crude study by the colorimetric method of the hydrogen ion concentration of the various decoctions employed leads to the conclusion that the titration of such media and the standardization of these on the basis of Fuller's scale are unsatisfactory. No adequate study of this point has been undertaken, and such determinations as were made served merely as a rough check on the conditions involved in our work. The values of P_H in the various natural decoctions employed were approximately as follows: apple, 4.3; mangold, 4.5; carrot, 5.3; and salmon, 6. It is interesting to note that although *Aspergillus* grows well in the natural mangold decoction with $P_H=4.5$, when brought to $P_H=6$, there is produced a heavier mat. As in the earlier experiments reported, the hydrogen ion concentrations of the solutions in which *Aspergillus* have grown are shifted toward the acid side, while in the contrary direction in the cultures which have supported *Gloeosporium*.

[1] Richards, H. M. Die Beeinflussung des Wachsthums einiger Pilze durch chemische Reize. Jahrb. f. wiss. Bot. 30: 665–688. 1897.